THE AMERICAN MUSEUM:

OR

REPOSITORY

OF ANCIENT AND MODERN

FUGITIVE PIECES, &c.

PROSE AND POETICAL.

For MARCH, 1788.

..... "*With sweeteſt flow'rs enrich'd,*
"*From various gardens cull'd with care.*" .....

..... "*Collecta revireſcunt.*"

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Obſervations upon an hypotheſis for ſolving the phenomena of light: with incidental obſervations, tending to ſhew the heterogeneouſneſs of light, and of the electric fluid, by their intermixture, or union, with each other. Communicated to the American academy of arts and ſciences, by James Bowdoin, eſq. preſident of ſaid academy, and late governor of the ſtate of Maſſachuſetts.

IN reviewing ſome letters I had written to a philoſophical friend, dr. Franklin, there occurred, on the ſubject of one of them, ſome obſervations, which appeared to me new. They are principally contained in the two laſt of three memoirs, which I ſhall lay before the academy: to whoſe judgment it will be ſubmitted, whether they have any thing beſide their novelty to recommend them.

As they were occaſioned by conſidering dr. Franklin's queries concerning light, the ſtrictures on thoſe queries, as being introductory to the obſervations, will make a part of theſe memoirs.

The firſt memoir will accordingly contain a few ſtrictures, or curſory remarks, on his hypotheſis for ſolving the phenomena of light: with incidental obſervations concerning the heterogeneouſneſs of light, and the electric fluid.

It is offered in full confidence, that our celebrated countryman, whoſe happy genius has contributed ſo largely to the advancement of philoſophic knowledge, will be pleaſed with any attempt for that purpoſe, whether ſucceſsful or not, even though it ſhould be upon principles, that may not perfectly harmonize with ſome of his own.

The doctor, diſſatisfied with the received doctrine concerning light, offers ſeveral objections to it, in the form of queries; and, in the ſame form, propoſes an hypotheſis of his own: both of which will be conſidered.

With reſpect to the hypotheſis, it is aſked—* "May not all the phenomena of light, be more conveniently ſolved, by ſuppoſing univerſal ſpace filled with a ſubtle elaſtic fluid, which, when at reſt, is not viſible, but whoſe vibrations affect that fine ſenſe in the eye, as thoſe of air do the groſſer organs of the ear? We do not, in the caſe of ſound, imagine that any ſonorous particles are thrown off from a bell, for inſtance, and fly in ſtrait lines to the ear: why muſt we believe that luminous particles

NOTE.

* See letters and papers on philoſophical ſubjects, page 265. edit. 1769.

leave the ſun, and proceed to the eye? Some diamonds, if rubbed, ſhine in the dark without loſing any part of their matter. I can make an electrical ſpark as big as the flame of a candle, much brighter, and therefore viſible further; yet this is without fuel: and I am perſuaded no part of the electric fluid flies off in ſuch caſe to diſtant places, but all goes directly, and is to be found in the place to which I deſtine it. May not different degrees of the vibration of the above-mentioned univerſal medium, occaſion the appearances of different colours? I think the electric fluid is always the ſame; yet I find that weaker and ſtronger ſparks differ in apparent colour: ſome white, blue, purple, red;—the ſtrongeſt white; weak ones, red."

Several objections here preſent themſelves. Some of them ariſing from the hypotheſis itſelf; and others from the compariſon of light with ſound.

In reſpect of the former, if univerſal ſpace be filled with a ſubtle elaſtic fluid, (ſo as to exclude any vacuum) that fluid muſt always be at reſt, and therefore, by the hypotheſis, always inviſible; and conſequently there would always be univerſal darkneſs. Or if any part of the fluid could be put in motion, the whole of it muſt be in motion: for not one particle of it could move, without moving, in the direction of its motion, the adjoining one, and this the next; and ſo on, *ad infinitum*. In this caſe, the leaſt motion, wherever it might commence, muſt produce univerſal motion; and conſequently, univerſal light; between which and univerſal darkneſs, there could be no medium.

But if the meaning of the expreſſion be, what it was probably intended to be, that univerſal ſpace, inſtead of being filled, doth greatly abound, with an elaſtic fluid, then would not every thing, which diſturbed that fluid, cauſe a luminous appearance? Would not the inhabitants of the ſea and air, in all their motions, beſpangle both; and thereby exhibit the various colours according to the different degrees of vibration, which thoſe motions might occaſion in the elaſtic fluid? As to ourſelves, would not a radiance attend us wherever we went? What occaſion ſhould we have of candle-light, when a quick vibration of the hand, or of machines made for that purpoſe, would diſpel the night? Or rather, might we not ſuppoſe there would be no night at all? for the action of the ſun (if the ſun ſhould be neceſſary) would be communicated to us, notwithſtanding the interpoſition of the earth. And would not the effect of that action, even at noon, when moſt direct, be only to enlighten us, unattended with heat, ſo eſſentially neceſſary to enliven and invigorate the animal and vegetable world?—Would not the elaſtic fluid, inſtead of exhibiting a round luminous body, which we call the ſun, be itſelf a continued univerſal blaze of light? And would not this, in the preſent conſtitution of things, obſtruct viſion, and totally alter the ſcience of optics?

The objections, implied in the foregoing queries, ſeem deducible from the hypotheſis. There are ſeveral, which appear to ariſe from the compariſon of light with ſound.

1ſt. As ſound (or a vibrating, or undulating motion in the air, which I conſider here as ſynonimous) is propagated from the ſonorous body in all directions—and ſurrounds, and is propagated beyond or behind any obſtacle in its way; ſo light, if it was a vibration, or undulation, of the elaſtic fluid, would ſurround, and be propagated behind an obſtacle, like ſound: but this does not agree with the fact. 2dly. As ſound or the vibrating motion in the air, origi-

ing in a houſe, or any other enclo-ſure, would, from a hole in one of the ſides of it, be propagated exter-nally, in circles, of which the hole would be the centre: ſo light, if it was a vibration, or occaſioned by a vibration, of the elaſtic fluid, af-ter paſſing through a hole, would be propagated in circles, of which the hole would be the centre. But this does not correſpond to the fact: for light, in paſſing through any uniform medium, always paſſes in right lines.

Beſide theſe, an objection ſimilar to one of thoſe, which have been ad-vanced againſt the common hypo-theſis, and which may be ſeen in the proper place, may be alleged againſt this, for the conſtant vibration, with which the elaſtic fluid muſt be agi-tated, would communicate to ſmall bodies, and even to large ones ſuſ-pended in that fluid, a conſtant tre-mulous, vibratory motion. In ſuch a caſe, it would be difficult to ex-amine the texture and viſible quali-ties of thoſe ſmall bodies, as one ne-ceſſary mean of examination, a great end of light, would increaſe the vibration; and thereby render the examination not only difficult, but impracticable. It is apprehended, however, that no ſuch motion, or diſturbance, in the making of theſe examinations, has ever been ob-ſerved.

What is mentioned about the elec-trical ſpark, that it is bright, and viſible at a diſtance, and this with-out fuel—and that no part of the electrical fluid flies off, in ſuch caſe, to diſtant places, but all goes direct-ly, and is to be found in the place, to which it is deſtined, appears to favour the hypotheſis: as the impli-ed inference ſeems to be, that the viſibility of the electric ſpark ariſes from the vibration it produces in the univerſal elaſtic fluid. But if the foregoing queries furniſh ſufficient reaſon for doubting the exiſtence of ſuch a fluid, or for doubting ſuch an effect from it, ſuppoſing its exiſtence, will they not furniſh equal reaſon for doubting the hypotheſis?

The viſibility of the electric ſpark may be accounted for, upon the prin-ciples of the received doctrine con-cerning light, without ſuppoſing any diminution of the pure electric fluid in the ſpark: no part of which, it is ſaid, flies off in the caſe menti-oned.

It ſeems not improbable, that the electric fluid is heterogeneous as well as light.

The heterogeneouſneſs of light is inferred from its colours, which are ſaid to vary proportionably, as the ſize of the particles doth vary; the variation becoming conſpicuous by a priſm, and by other means, which claſs the particles according to their reſpective magnitudes, or degrees of refrangibility and reflexibility.

Beſide this, another reaſon may be ſuggeſted, from which the hetero-geneouſneſs of light may be deduced: namely, becauſe it exhibits effects ſimilar to ſome of thoſe of electricity. For example, a globe or pane of glaſs warmed in the ſun, or before a fire, will ſucceſſively attract and repel ſmall cork balls, down, and ſuch like bodies inſulated, and properly circumſtanced; and will ſhew other ſigns of electricity communicated to the glaſs by the ſun or fire.

So, in regard to electricity, its heterogeneouſneſs may be collected from its producing effects reſembling ſome of thoſe of light or fire; which are here conſidered as equivalent terms.

Electricity and fire differ in many reſpects, and in ſome they agree; as hath been ſhewn in dr. Franklin's letters on electricity. So far as they agree in their effects, their nature may be preſumed to be alike; or rather, from that agreement and

ſimilitude of effects, I think it may be inferred, that they are mixed with, and generally do accompany each other: and that each produces its own effect at the time of their joint operation. The effects of electricity, ſimilar to thoſe of fire, being produced by the fire mixed with it; and the effects of fire, reſembling thoſe of electricity being produced by the electricity mixed with that: the compound taking its name from the predominant principle.

Thus, fire inflames bodies, and throws its particles or light at a diſtance. Hence the exploſion of gunpowder, and the luminous appearance, occaſioned by the electric ſpark: the fire mixed with it producing thoſe effects.

Thus alſo, electricity attracts and repels certain ſmall bodies alternately, under given circumſtances. Hence, the alternate attraction and repulſion of glaſs, and ſome other things, heated by fire: the electricity mixed with the communicated fire producing thoſe effects.

In this way, I would infer the heterogeneouſneſs of light and electricity, and their mixture with each other; and in this way, account for the ſimilitude and difference of their effects; and for the luminous appearance or viſibility of the electric ſpark in particular, without diminiſhing the pure electric fluid contained in it: all of which, in the caſe referred to, is ſaid to go directly, and is to be found in the place, to which it was deſtined.

On the ſame principles, the ſhining of diamonds in the dark, when rubbed, and thereby electrified, may be accounted for, without ſuppoſing they loſe any part of their matter.

In regard to the different colours of the electric ſpark, which are more or leſs ſtrong according to the ſtrength of the ſpark, they correſpond to the different colours of light or fire, which are more or leſs vivid according to the denſity or intenſeneſs of that element. This ſameneſs of effect ſhews a ſameneſs of cauſe, or that the light or fire mixed with the electric ſpark produces thoſe colours: whoſe ſtrength or vividneſs being according to the bigneſs of the ſpark, or to its quantity of electric fluid, makes it probable, than in proportion to the quantity, there is more or leſs light or fire contained in that fluid.

Thoſe different appearances ſeem to be a further inſtance or proof of the heterogeneouſneſs of the electric fluid; and, taken in connexion with other appearances above-mentioned, ſhew the intermixture, and the conſequent heterogeneouſneſs, of the two elements.

The next thing to be conſidered, is, the objection to the received doctrine concerning light. But this will be the ſubject of another memoir.

Obſervations on light, and the waſte of matter in the ſun and fixed ſtars, occaſioned by the conſtant efflux of light from them: with a conjecture, propoſed by way of query, and ſuggeſting a mean, by which their ſeveral ſyſtems might be preſerved from the diſorder and final ruin, to which they ſeem liable by that waſte of matter, and by the law of gravitation. Communicated to the American academy of arts and ſciences, by James Bowdoin, eſq. preſident of ſaid academy, and late governor of the ſtate of Maſſachuſetts.

HAVING in a preceding memoir laid before the academy the obſervations that occurred on the ſubject of dr. Franklin's hypotheſis relative to light, I ſhall now conſider his objections to the received doctrine concerning it.

The objections will appear by the

following paragraph taken from one of his letters on philoſophical ſubjects.

"I muſt own, ſays the doctor*, I am much in the dark about light. I am not ſatisfied with the doctrine, that ſuppoſes particles of matter called light, continually driven off from the ſun's ſurface, with a ſwiftneſs ſo prodigious! Muſt not the ſmalleſt particle conceivable, have, with ſuch a motion, a force exceeding that of a twenty-four pounder, diſcharged from a cannon? Muſt not the ſun diminiſh exceedingly by ſuch a waſte of matter, and the planets, inſtead of drawing nearer to him, as ſome have feared, recede to greater diſtances through the leſſened attraction? Yet theſe particles, with this amazing motion, will not drive before them, or remove, the leaſt and lighteſt duſt they meet with: and the ſun, for aught we know, continues of his ancient dimenſions; and his attendants move in their ancient orbits."

The doctor's diſſatisfaction with the received doctrine, is founded on two objections implied in his queries, and which may be expreſſed in the following propoſitions.

1ſt. That ſuppoſing the doctrine true, the ſmalleſt particle of light muſt be driven to us with prodigious force, a force exceeding that of a twenty-four pounder, diſcharged from a cannon. But this is contrary to fact.

2dly. That the ſun muſt be exceedingly diminiſhed by ſuch a waſte of matter; and the planets, in conſequence of it, muſt recede to greater diſtances from him. But, for aught we know, both the ſun and the planets, continue in their ancient ſtate.

NOTE.

* See letters and papers on philoſophical ſubjects, page 264. edit. 1769.

From theſe propoſitions it is implicitly inferred, that the doctrine is not well founded.

Among the obſervations on the ſecond propoſition, an hypotheſis will be propoſed, by way of query, ſuggeſting a mean, whereby the material ſyſtem, collectively taken, might be preſerved from the diſorder and ruin, to which they ſeem liable from cauſes hinted at in that propoſition.

In regard to the objection contained in the firſt propoſition, it adopts the idea, that light, like any other body in motion, will ſtrike with a force proportioned to the degree of its motion: which degree of motion, or the celerity, multiplied by the quantity of matter in the body, will, in the reſult, expreſs its force or momentum.

If, then, we can ſuppoſe the quantity of matter in a particle of light to be, not indeed abſolutely, but comparatively, o, its momentum will alſo be comparatively o; and it can have, in that caſe, no viſible effect on the ſmalleſt particle of duſt, to remove it.

Let us now conſider what reaſon there is for ſuch a ſuppoſition. In order to that, I beg leave to introduce here, a paragraph, from one of my letters to dr. Franklin, printed with his letters and papers on philoſophical ſubjects. It runs thus*, "The flame of a candle, it is ſaid, may be ſeen four miles round. The light, diffuſed through this circle of eight miles diameter, was contained, before it left the candle, within a circle of half an inch diameter. If the denſity of light, in theſe circumſtances, be as thoſe circles to each other, that is, as the ſquares of their

NOTE.

* Letters, &c. p. 275.

diameters (or, which is equivalent, if the denſity decreaſes as the ſquare of the diſtance or ſemi-diameter increaſes, the candle-light, when come to the eye, will be 1,027,709,337,600 times rarer than when it firſt quitted the half-inch circle. Now the aperture of the eye, through which the light paſſes, does not exceed one tenth of an inch diameter, and the portion of the leſs circle, which correſponds to this ſmall portion of the greater circle, muſt be proportionably, that is, 1,027,709,337,600 times leſs than one-tenth of an inch: and yet this infinitely ſmall point (if you will allow the expreſſion) affords light enough to make it viſible: or rather affords light ſufficient to affect the ſight at that diſtance."

If the calculation, referred to in that paragraph, be juſt—and we ſhould ſuppoſe a ſingle particle of light, though incomparably ſmaller, to be in bigneſs equal to that point—I would aſk whether the quantity of matter in ſuch a particle would not be ſmall in a greater degree than its velocity, equal to that of the ſun's light, would be great? If ſo, a particle of light in motion, agreeably to the foregoing ſuppoſition, may be here eſtimated o, and its momentum not ſufficient to remove the lighteſt duſt; much leſs to do as much execution as a twenty-four pounder, diſcharged from a cannon.

It is impoſſible to calculate the momentum, where the requiſite data cannot be had: but ſuppoſing the candle-flame equal in bulk to a ſphere of half an inch diameter, and to weigh as much as an equal bulk of air, viz. about one thirtieth part of a grain; though in fact its gravity is incomputably leſs than that of air: then the ſquare aforeſaid will expreſs the proportion, in which the denſity of the candle-light is diminiſhed at the verge of the greater circle: and the ſame proportion of one thirtieth of a grain will expreſs the weight of that light at the verge, viz. one 30,831,280,128,000th part of a grain; which we will conſider as the weight of a ſingle particle of the ſun's light. If the velocity of light be at the rate of 80,000,000 miles in ſix minutes, then its velocity will be 222,222 miles, equal to 14,079,985,920 inches, in a ſecond. This number of inches, divided by 30,831,280,128,000, the ſuppoſed particles in a grain, will ſhew the degree of motion required in a body weighing one grain, to give it a momentum, equal to that of a particle of light, upon the hypotheſis aſſumed: which motion will be 456 millionth parts of an inch in a ſecond, equal to one inch in 2190 ſeconds, or thirty ſix minutes and an half; and is much ſlower than the hour-hand of a common clock; which, with its greater degree of motion, and much greater quantity of matter, does not give to the ſmalleſt bodies, placed in its way, any viſible motion.

Preciſion in this calculation is not aimed at, and the nature of the ſubject does not admit of it: but it is apprehended it will appear ſufficiently evident from it, that light, even if its velocity were much greater than it is, and its gravity equal to that of air, to which, with great diſadvantage to the argument, it has been, in that reſpect, compared, cannot drive before it the lighteſt duſt, or, indeed, give it any ſenſible motion at all.

To the ſame purpoſe it may be further obſerved, that light reflected to the eye through a microſcope and priſm, would, it is apprehended, exhibit the ſame variety of colours, as light coming directly from the ſun. In which caſe, the ray ſo viewed, (like the candle-ray, which has been

conſidered as a ſingle particle only) muſt be compoſed of a multitude of particles; and be a proof, that the particles of light are inconceivably ſmaller than the calculation ſuppoſes. This degree of ſmallneſs, however, repreſents them to be of great magnitude, compared with their real ſize: for, when we conſider, that the ſun's light is diffuſed through the whole ſolar ſyſtem, and much beyond it—and that a part of it, in that attenuated ſtate, is reflected to us from the planets, in which reflection it undergoes, by its divergence, a further, and an extreme, attenuation—and eſpecially, when we conſider the immenſe ſphere, throughout which the light of the fixed ſtars is viſible, particularly thoſe of them, whoſe diſtance is ſo vaſt, that, at oppoſite points of the earth's orbit, they have no ſenſible parallax—the diviſibility of light, and the proportionable tenuity of its particles, confound the imagination; and render human calculation inadequate to expreſs the preciſe degree of them, or the inconſiderableneſs of the momentum of thoſe particles.

This inadequateneſs is particularly applicable to the foregoing calculation: which was purpoſely made on the diſadvantageous principles aſſumed in it, to ſhew, that even on ſuch principles, the momentum of light could produce no viſible motion in the ſmalleſt bodies, that fall under our notice. But had the calculation been founded on the ſtate of the ſun's light, reflected from one of the planets, for inſtance, the Georgium Sidus, lately diſcovered by mr. Herſchell, the reſult would have been widely different; and we ſhould, in that caſe, have had a juſter idea of the momentum. The light reflected to the earth from that planet, whoſe mean diſtance from the ſun is ſaid to be 2,000,000,000 miles, is ſo extremely attenuated, that the momentum of a particle of it, transferred to a body, weighing a millionth part of a grain, would communicate to it ſo ſmall a degree of motion, that it would require millions of ages for that body to move the diminutive part of an inch mentioned in that calculation.

If theſe obſervations be juſt, it is apprehended they ſhew, with ſome degree of evidence, that a particle of light, notwithſtanding its prodigious velocity, cannot, by its impulſe, remove other bodies, or diſplace even the fineſt microſcopic duſt; and that the doctrine objected to, may be true, notwithſtanding the firſt of the two objections, which have been made to it.

The ſecond propoſition, containing the other objection, is, that in caſe there are particles of matter, called light, continually driven off from the ſun's ſurface, the ſun muſt be exceedingly diminiſhed by ſuch a waſte of matter; and the planets, in conſequence of it, muſt recede to greater diſtances from him, through the leſſened attraction.

Here I beg leave to obſerve, that if the material ſyſtem, in its preſent form, was not intended by its Creator to be perpetual, then the waſte of the ſun's matter, and the conſequent diſorder in the ſyſtem, ariſing from the altered ſtate of its gravitation, will only be a proof of that intention: and not operate againſt the truth of the doctrine.

That ſyſtem, like every other, derived from the ſame original, doubtleſs has within itſelf the means of continuing in its preſent form, until the great and wiſe purpoſes of its author ſhall be brought into effect, and completely anſwered.

With reſpect to the ſolar ſyſtem, ſo far as its continuance depends on the ſun, it ſeems calculated, notwithſtanding the ſuppoſed waſte of the ſun's matter, to laſt for many

ages; for the ſun, by reaſon of its prodigious bulk, and the diviſibility of its matter, muſt, from its own internal ſources, furniſh light to the ſyſtem, through a long tract of time, without being ſenſibly diminiſhed. If thoſe eccentric bodies, called comets, which have been thought intended to recruit the ſun's waſte of matter, do in fact anſwer that purpoſe, proviſion is then made for the preſervation of the ſyſtem, at leaſt until thoſe bodies ſhall have all ſucceſſively fallen into the ſun, and been expended. When that ſhall happen, if there be provided no further means of recruit, the ſyſtem will begin to decay, and finally be reduced to a chaotic ſtate: from which, like our earth, it may be reſtored in ſome new form, to anſwer the further purpoſes of the Creator. I mention our earth, as in the Moſaic account of it, its original is deſcribed in ſuch a manner, as to give us the idea of its having been an old planet, by ſome means or other reduced to a chaos; from which it was renovated, and made ſuitable for the purpoſes, to which it has been applied.

There is nothing unreaſonable, or improbable, in that idea: and if the earth was ſo renovated, it may be inferred from analogy, that in caſe the preſent ſyſtem ſhould go to decay, a new one, and perhaps a ſuperior one, would ariſe from its ruins.

Theſe obſervations are founded on the idea of the waſte of the ſun's matter, and its final diſſolution, with that of the ſyſtem depending upon it: whether gradually occaſioned by that waſte of matter, or more rapidly brought on by the general law of gravitation. In this view of things, the objection does not militate with the doctrine.

But perhaps it may be thought more philoſophical, and that it would better comport with our ideas of the wiſdom of the Creator, to ſuppoſe, that when he created the ſyſtem, he intended it ſhould be a permanent one; and at the ſame time furniſhed it with the means of its own preſervation. In which caſe, may it not be further ſuppoſed, particularly with regard to the efflux of light from the ſun, by which its matter is conceived to be waſted, that he provided means whereby the effluent particles, after anſwering the purpoſe of their efflux, ſhould be returned to the ſun, to anſwer again, in a conſtant ſucceſſion, the ſame purpoſe?

I do not know, whether the hypotheſis, ſuggeſted in the following queries, and relative to that ſubject, be admiſſible, or not. It is however offered for conſideration.

It was primarily and ſpecially intended to ſuggeſt a mean for preventing the ruin, to which the material ſyſtem ſeems liable, from the general principle of gravitation: but the ſame mean may poſſibly be applied to reſtore to the ſun, in a regular ſucceſſion, its effluent light; and thereby obviate the evil effects that might otherwiſe follow from the efflux.

Is it not conceivable, that round the ſolar ſyſtem, and the ſeveral ſyſtems, which compoſe the viſible heavens, there might have been formed a hollow ſphere, or orb, made of matter, *ſui generis*, or of matter like that of the planets, and ſurrounding the whole; having its inner or concave ſurface at a proper diſtance therefrom; beyond which ſurface light could not paſs, and between which, and the particles of light, there ſhould be a mutual repulſion? And might not the ſun, or ſource of light, of each ſyſtem, have been ſo placed, in reſpect of each other, and the concave ſurface of the ſurrounding orb, that there ſhould be, by direct and repeatedly indirect reflexions, an interchange of rays between them, in ſuch a manner, as that to

each there ſhould be reſtored the quantity it had emitted; and thereby the waſte of its matter be prevented: and this at the ſame time it diſpenſed its light to its particular ſyſtem?

This uſe of ſuch an orb is here meant to be conſidered as a ſecondary or incidental one; to which it might be applied: but the principal or primary uſe of it, as a counterbalance to the gravitating principle of the ſyſtems contained within it, will be ſeen in its proper place.

There is a remarkable phenomenon in the ſolar ſyſtem, to which the ideal one, juſt mentioned, bears ſome reſemblance, and by which it was ſuggeſted: I mean the ring or arch, which ſurrounds the planet Saturn. We are told by aſtronomers that its width, and alſo its diſtance from Saturn, is about 25,000 miles —forming around that planet a beautiful arch, which may be deſigned, among other purpoſes, to increaſe its light and heat by reflecting upon it, like a concave mirror, the ſun's rays: of which, by reaſon of its great diſtance from the ſun, it would not otherwiſe have had a ſufficient quantity.

If Saturn were a luminous body, per ſe, and the arch, (made of ſuitable matter, and properly conſtructed, for the purpoſe) entirely environed it, the whole quantity of light emitted from it, would be reflected back; and no waſte of its matter ariſe from that emiſſion. The ſame kind of hollow ſphere or orb, ſurrounding, for inſtance, the ſolar ſyſtem, would anſwer the ſame purpoſe. Its ſun being in the centre of the orb, would have all its light reverberated back to it: except the comparatively ſmall quantity intercepted by the planets: a great part of which quantity would, by direct, and indirect reflexions, be returned to the ſun; and a quantity equal to the remainder, by means of volcanoes, and other internal fires in the planets, might be thrown off from them, and conveyed to the ſun; whereby the equilibrium of the whole might be preſerved.

Such an orb for a ſingle ſyſtem appears ſimple and plain; and ſuch an one for the whole choir of ſyſtems, though ſeemingly more complicated, might yet appear equally ſuitable for the purpoſe, when its ſtructure, and the laws and principles which governed it, and alſo the ſituation of the ſeveral ſyſtems relative to it, and to each other, ſhould become known.

Its ſtupendous extenſion would be no objection to the ſuppoſition of its reality: for if the convenience and pleaſure of the inhabitants of Saturn were a ſufficient reaſon for furniſhing that planet with its maſſy ring, the preſervation of ſuch a choir of ſyſtems, with the aſtoniſhing multitudes of their inhabitants, would juſtify and ſufficiently ſupport the ſuppoſition of ſuch an orb: eſpecially, when it is conſidered, that beſides anſwering the grand purpoſe of preſerving thoſe ſyſtems, it might, perhaps, like Saturn's ring, be provided on both ſides of it, with ample means of making it a ſuitable place for habitation— the habitation of myriads of millions of animate beings, equal or ſuperior to thoſe, which people our planetary ſyſtem.

Beyond that orb, at proper diſtances, it is conceivable, there might be other concentric orbs, equally ſuitable for habitation, and alike inhabited: including within them innumerable ſyſtems of planets, reſembling the ſolar ſyſtem, and like that animated, and adorning the infinite expanſe.

To this hypotheſis, objections may be made, and ſuch as might prove it to be, like many a one which has

preceded it, a mere philoſophical reverie. But before it be ranked in that claſs, I would aſk, whether, if there be no ſuch orb, nor any thing to anſwer a like purpoſe, the law of gravitation, that univerſal law, on which the philoſophy of the immortal Newton is founded—by which, with ſuch admirable ſagacity, he has explained the phenomena of material nature—and on which he makes its preſervation depend, will not finally bring on its diſſolution? Or rather, whether the operation of that law would not long ago have brought it on?

The ſun of our planatery ſyſtem, and the ſuns (called fixed ſtars) of other ſyſtems, and therefore the ſyſtems themſelves, do probably, according to aſtronomical obſervations, poſſeſs the ſame relative place; or are, in reſpect of each other, fixed. But how are the exterior ſyſtems (ſuppoſing the whole not boundleſs) prevented from approaching towards the common centre of gravity: from which, if they have no revolution round it, (which the like obſervations make probable) they cannot be kept by a projectile or centrifugal force? Muſt they not conſtantly by that law be drawn, with an accelerating motion, towards that centre; and finally, with the whole choir of ſyſtems, directed by that law, arrive at it with ſucceſſive tremendous craſhes, until the deſtruction of the whole would be completed? and could any thing, but the interpoſition of the power which created them, prevent it*?

If ſuch a cataſtrophe would be the effect of that law, would it not demonſtrate the wiſdom and foreſight of the Creator, to ſuppoſe, he provided the means of counteracting that effect, at the ſame time he ordained the law? And among the poſſible means of doing it, is it not conceivable, that a hollow ſphere, or orb, analogous to that above deſcribed, might be one?

It has been ſuggeſted in what way ſuch an orb might prevent the gradual waſte and decay of the material ſyſtem. Let us now ſee, whether it might not be applied to prevent the ſwifter and more dreadful cataſtrophe, to which the law of gravitation, in certain circumſtances, ſeems capable of ſubjecting that ſyſtem.

The deſcribed orb, like every other body, would poſſeſs the gravitating principle, in proportion to its quantity of matter: which, in different parts of the orb, might be more or leſs denſe, as the effect, intended to be produced, might require. Where a ſtrong attractive power might be neceſſary, the denſity would be greater; and ſo, *vice verſâ*: and to aſſiſt or co-operate with it, a magnetic power might be ſuperadded.

Thus conſtituted, and furniſhed with thoſe, and other needful qualities, and ſurrounding the whole viſible choir of ſyſtems, might not the orb, by the principle of gravitation, either alone or aſſiſted, keep thoſe ſyſtems, next to it, from being drawn towards the centre of gravity by their own, and the

NOTE.

* Mr. Whiſton obſerves, "It is by no means impoſſible, that all the bodies in the univerſe ſhould approach to one another, and at laſt unite in the common centre of gravity of the entire ſyſtem: nay from the univerſality of the law of gravitation, and the finiteneſs of the world, in length of time, except a miraculous power interpoſe and prevent it, it muſt really happen." Diſcourſe, introductory to his theory, p. 38.

…tual action of the interior ſyſ-…ms? And might not thoſe ſeveral …ſtems be ſo placed, and the den-…ties of the bodies reſpectively be-…nging to them, with the denſities …f the ſurrounding orb, and conſe-…quently their mutual gravitating …ower, be ſo regulated, and adjuſted, …s to keep them all at the diſtance …aſſigned them; and forever prevent …heir approximating, either to the …centre of the general ſyſtem, or to …the ſurrounding orb: all of them to-…gether thus conſtituting an undecay-…ing permanent whole?

It has been obſerved by philoſo-…phers, "that a body placed any …where, within a hollow ſphere, …which is homogeneous, and every …where of the ſame thickneſs, will …have no gravity, whereſoever it be …placed: the oppoſite gravities al-…ways preciſely deſtroying each o-…ther." But that obſervation can-…not be applied to the hollow ſphere …of an orb, above deſcribed: for by the …deſcription, it is not homogeneous. …Nor need it be of equal thickneſs: …which, however, is a circumſtance …worthy conſideration, if equal thick-…neſſes, with different degrees of den-…ſity in different parts, would anſwer …the purpoſe.

The phenomena of nature, upon …the ſuppoſition of ſuch an orb, would …plainly be the ſame, *cæteris paribus*, …as now take place. Whether that …ſuppoſition be ſupported by phæno-…mena, and what other foundation …there is for it, will be the ſubject of …a future memoir.

NOTE.

"Chambers's Cyclopædia, under …the word, gravity.

Obſervations tending to prove, by phænomena and ſcripture, the exiſtence of an orb, which ſurrounds the whole viſible material ſyſtem; and which may be neceſſary to preſerve it from the ruin, to which, without ſuch a counterbalance, it ſeems liable by that univerſal principle in matter, gravitation. Communicated to the American academy of arts and ſciences, by James Bowdoin, eſq. preſident of the ſaid academy, and late governor of the ſtate of Maſſachuſetts.

AT the concluſion of a memoir, entitled, "Obſervations on light," &c. which I have had the honour to lay before the academy, it was intimated, that there are phænomena in nature, and other evidence, tending to prove the exiſtence of an orb, that ſurrounds the whole viſible material ſyſtem.

The evidence is—phænomena and ſcripture.

The phænomena are,—the luminous girdle in the blue expanſe, called the Milky Way—other luminous appearances in it—and the expanſe itſelf.

In regard to the luminous girdle, or Milky Way.—This phænomenon has been ſuppoſed to reſult from the combined luſtre of infinite multitudes of ſtars, too diſtant to be diſtinctly viſible. But although it be obſerved through teleſcopes, that there is a great number of ſtars in the Milky Way, on which circumſtance the ſuppoſition is founded, they appear as ſtars ſet in it, diſtinguiſhable from it, and not contributing to form the phænomenon.

The ſuppoſition not only diſagrees with the appearance, but is inconſiſtent with every philoſophical idea concerning thoſe ſtars. They are repreſented to be ſuns: each having its ſyſtem of planets revolving round

it; and conſequently requiring a ſpace proportioned to their number, and the extent of their ſyſtems: which ſpace, for ſuch multitudes of them as the ſuppoſition implies, muſt be beyond conception immenſe: and through which they muſt therefore be diſperſed at ſuch diſtances, that comparatively few of them could be viſible by us; and that the whole together would not blend their light to cauſe that phenomenon.

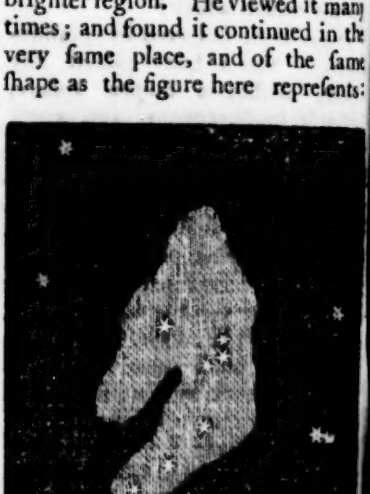
On the contrary, the phenomenon ſtrikes us, as it may be ſuppoſed ſuch a luminous girdle would ſtrike, if its light were reflected from the concave ſurface of a far-diſtant orb: to which, on the hypotheſis aſſumed, it had been propelled from the numerous ſyſtems which the orb enfolds.

The ſame idea is ſuggeſted by the different degrees of its light, from a ſmall light to a faint one, ſcarcely diſcernible; by the frequent interruptions of it; and by the large chaſm, which, for a conſiderable ſpace makes the girdle appear double and very irregular.

Theſe appearances may be occaſioned by the ſituation of the earth, in reſpect to thoſe parts of the orb, from which certain cones of light (preſently to be explained) are reflected; and by that particular conſtruction, and configuration of thoſe parts; by means of which thoſe cones are broken and irregularly reflected to the earth: whoſe different ſituations in its orbit, by reaſon of its great diſtance from the orb, would occaſion no ſenſible difference iu the appearance.

With reſpect to the other luminous appearances in the concave expanſe, I beg leave here to introduce ſeveral obſervations upon that ſubject, from two authors, who have diſtinguiſhed themſelves in the aſtronomical branch of ſcience.

One of them, dr. Smith, in his ſyſtem of optics, * obſerves that Hugenius, in the year 1656, looking by chance through a large teleſcope, at three ſmall ſtars very cloſe to one another, in the middle of Orion's ſword, ſaw ſeveral more as uſual. But the three little ſtars very near one another, (marked θ by Bayer) together with four more, ſhone out as it were through a whitiſh cloud much brighter than the ambient ſky which being very black, cauſed the lucid part to appear like an aperture, which gave a proſpect into a brighter region. He viewed it many times; and found it continued in the very ſame place, and of the ſame ſhape as the figure here repreſents:



and called it, *portentum, cui certe ſimile aliud nuſquam apud reliquas fixas potuit animadvertere.*"

He alſo obſerves, that "in the philoſophical tranſactions, † there is an account of a later diſcovery of five more ſuch lucid ſpots, though leſs conſiderable than this of Hugenius; the middle of which, we are there told, is at preſent in □.

NOTES.

* P. 447—8

† No. 347, Jones's Abr. vol. iv. p. 224.

19° 00′ with ſouth latitude 28° 45′ and that it ſends forth a radiant beam into the ſouth-eaſt, as another in the girdle of Andromeda ſeems to do into the north-eaſt. It is alſo there remarked, that though theſe ſpots are in appearance but ſmall, and moſt of them but a few minutes in diameter; yet, ſince they are among the fixed ſtars, as having no annual parallax, they cannot fail to occupy ſpaces immenſely great; and, perhaps, not leſs than our whole ſolar ſyſtem: in all which ſpaces, it ſhould ſeem, that there is a perpetual uninterrupted day."

The other author, mr. Ferguſon, ſpeaking of the Milky-Way, ſays*, "There is a remarkable tract round the heavens, called the Milky-Way, from its peculiar whiteneſs, which was formerly thought to be owing to a vaſt number of very ſmall ſtars therein: but the teleſcope ſhews it to be quite otherwiſe; and therefore its whiteneſs muſt be owing to ſome other cauſe. This tract appears ſingle in ſome parts, in others double. "There are ſeveral little whitiſh ſpots in the heavens, which appear magnified, and more luminous, when ſeen through teleſcopes; yet without any ſtars in them." Five of which ſpots he particularly mentions.

He next obſerves, that "cloudy ſtars are ſo called from their miſty appearance. They look like dim ſtars to the naked eye: but through a teleſcope, they appear broad illuminated parts of the ſky; in ſome of which is one ſtar, in others more. But the moſt remarkable of all the cloudy ſtars, is that in the middle of Orion's ſword, where ſeven ſtars (of which three are very cloſe together) ſeem to ſhine through a cloud very lucid near the middle, but faint and ill-defined about the edges. It looks like a gap in the ſky, through which one may ſee, as it were, part of a much brighter region."

Theſe quotations, without making any comment upon them, ſhew, that the Milky-Way is not owing to the ſtars contained in it; that the teleſcope ſhews it to be quite otherwiſe; and that it muſt be owing to ſome other cauſe: that, in reſpect to the lucid ſpots, in ſome of them there are no ſtars; in others but few; and that one of them exhibits a remarkable appearance of an aperture, or gap, that gave a proſpect into a brighter region: that the ſpaces they occupy, though ſmall in appearance, are, perhaps, not leſs than our whole ſolar ſyſtem; and that in them it ſhould ſeem there is perpetual uninterrupted day.

From theſe phenomena it ſeems not improbable, that the Milky-Way, and thoſe lucids ſpots, are parts of a concave body or orb, of the ſame nature with ſome of the other heavenly bodies; and, whoſe light tranſmitted to us, exhibits thoſe phenomena, according to the laws and circumſtances, which regulate it.

There is another, and ſtill more remarkable phenomenon, that ſuggeſts the idea of ſuch an orb; I mean the blue concave expanſe, which ſurrounds, and appears to limit viſible nature; and which is the laſt to be conſidered.

It is thus explained by ſir Iſaac Newton; who obſerves, that all the "vapours, when they begin to condenſe and coaleſce into natural particles, become firſt of ſuch a bigneſs as to reflect the azure rays, ere they can conſtitute clouds of any other colour. This, therefore, being the firſt colour they begin to reflect, muſt be that of the fineſt

NOTE.

* Aſtronomy, p. 339—40. Edit.

and moſt tranſparent ſkies: in which the vapours are not arrived to a groſſneſs ſufficient to reflect other colours."

By this explanation, it appears, that the cauſe of this phenomenon exiſts within the earth's atmoſphere. If it really doth exiſt within it, the phenomenon, from the aſſigned cauſe of it, ſeems to be nothing more than a blue tranſparent cloud, more or leſs extenſive, in proportion as the atmoſphere may happen to be leſs or more charged with other clouds.

If this were the cauſe, would not the heavenly bodies, in a clear ſky, partake of the colour of that cloud, and appear blue, or be tinged with it, by means of their light paſſing through the blue cloud? And would not this appearance indicate, that the blue rays of their light were tranſmitted, and the other coloured rays, for the moſt part, reflected, from the atmoſphere? Would not that tranſmiſſion of the blue rays occaſion all bodies around us to appear blue, ſo long as the atmoſphere, continuing clear, ſhould exhibit the blue cloud*? And would not the colours of thoſe bodies vary, as other coloured clouds ſhould ſucceed and predominate.

Would not this reflection of the other coloured rays occaſion not only a decreaſe of light, but, with reſpect to the ſun, a great diminution of its heat? If the ſeveral different coloured rays do each, in reſpect to heat, produce an equal effect; and all but the blue rays are reflected, ſhould we not in a clear day, be deprived of ſix-ſevenths, or a proportionable part, of the ſun's heat, which the ſeven ſorts of rays, had they been all tranſmitted, would have afforded?

Such appearances and effects might have been expected, if the aſſigned cauſe produced the phenomenon for the ſun's light and other light and alſo bodies in general, whatever be their colour, being viewed through a medium of any original colour will appear of that colour, or ſtrongly tinged with it. But it is apprehended, that no ſuch appearances and effects have ever been obſerved; and, therefore, that there is reaſon to doubt the reality of the cauſe aſſigned: the inſufficiency of which may further appear in the courſe of theſe obſervations.

But how is the exiſtence of this orb deduced from the phenomenon?—in the ſame manner as the exiſtence of the other heavenly bodies, and the exiſtence of the bodies around us are deduced: namely, from the uniformity and permanency of their viſible qualities, or phenomena.

In regard to bodies around us, whenever by ſight we have been impreſſed with certain ideas of colour, form, and magnitude, correſponding to bodies near us, and at an approachable diſtance, we have found by conſtant and uniform experience derived alſo from, and confirmed by every other ſenſe and means of information, that ſuch bodies do really exiſt: and having thus from experience gained the knowledge, that certain phenomena do infallibly indicate the exiſtence of thoſe bodies, the phenomena themſelves do alone become the undiſputed evidence of that exiſtence.

Nature is ſimple and uniform in its operations. From the ſame cauſe follow like effects; and theſe indicate the ſame cauſe. Bodies of every kind, through the medium of light, produce their reſpective phenomena, and theſe demonſtrate the reality of thoſe bodies.

NOTE.

* Chambers's Clyclopædia, under the word blueneſs.

From theſe principles, we infer the reality of thoſe terreſtrial bodies, which, by reaſon of their ſituation and diſtance, can only be the objects of ſight: and from the ſame principles we alſo infer the reality of the heavenly bodies, the planets and fixed ſtars. If this laſt inference be juſt, is it not equally juſt to infer from the ſame principles, the reality of the blue circumambient expanſe? that is, that it is a real concave body, encompaſſing all viſible nature: which is the exact deſcription of the concave ſurface of the orb abovementioned.

There is one appearance of the blue expanſe, which may be thought to militate with the foregoing account of it.

In a clear day, it appears of a brighter blue than in the night, occaſioned by the ſun's light, reflected to us by the earth's atmoſphere. From which circumſtance, it might be ſuppoſed, that the cauſe of the phenomenon doth exiſt within the atmoſphere, and is the atmoſphere itſelf, or its vapour. It is apprehended, however, that this would be a miſtaken ſuppoſition; and that the appearance may be explained on principles, which will not only invalidate the ſuppoſition, but further ſhew the inſufficiency of the cauſe, to which the phenomenon has been aſcribed.

For that purpoſe it may be obſerved, that the atmoſphere being inviſible, muſt be without colour; and has, perhaps for that reaſon, no greater diſpoſition to tranſmit or reflect to us the blue rays of light, whether of the ſun or ſtars, than thoſe of the other colours: and, therefore, if the phenomenon be produced by means of the blue rays of thoſe luminaries (which I ſhall attempt to explain) the atmoſphere cannot be the cauſe of that production.

With reſpect to the vapours in the atmoſphere, which, in a particular ſtate, are ſaid to occaſion the phenomenon, they being of different degrees of groſſineſs or denſity, muſt arrange themſelves according to that denſity, or their ſpecific gravity. If then any of the ranges conſiſted of vapour, in a proper ſtate to tranſmit or reflect to the eye the blue rays only, the effect of it would be deſtroyed, or changed, by the groſſer vapour in the lower range. Or if it ſhould ſo happen (which ſeems very improbable) that the whole body of vapour ſhould conſiſt of particles of the due ſize, and in the proper ſtate to reflect the blue rays, it could not long continue in that ſtate, by reaſon of the changeable nature of the vapour, and the numerous cauſes, that are conſtantly operating to produce a change in it. But the phenomenon is uniform and permanent; and therefore muſt be the effect of an uniform and permanent cauſe.

If theſe obſervations have any foundation, neither the atmoſphere nor its vapour, aſſiſted by, or aſſiſting, the direct light of the ſun and ſtars, can be the cauſe of the phenomenon.

The atmoſphere, however, or its finer and tranſparent vapour, contributes to the brighter hue of the phenomenon by day: which may be thus explained:

The ſun's light in its mixed ſtate, reflected by the atmoſphere, or by the tranſparent vapour floating in it, enters the eye at the ſame time with the blue light of the expanſe; and both together delineate on the retina an image, formed by their united rays, each producing its effect. The light from the expanſe exhibiting the blue image; the light from the ſun illuminating or brightening the image; and both together impreſſing the idea of that phenomenon, as it is diſplayed in a clear day.

If it ſhould be aſked, from whence the concave expanſe derives its light, the anſwer is—from the numberleſs planetary or ſolar ſyſtems, which it includes: and particularly from thoſe in the neighbourhood of it, which directly anſwer the purpoſe of enlightening and, in other reſpects, accommodating its inhabitants.

This light, tranſmitted to the expanſe through its atmoſphere, is reflected back directly and indirectly to the ſyſtems from which it iſſued, to be again, in a due ſucceſſion, remitted to, and reflected from, the expanſe. By ſuch a reciprocation, and mutual interchange of light with each other, and among themſelves, the ſeveral parts may be ſupplied with the quantity they had reſpectively emitted; and the equilibrium of the whole maintained: whereby the evils, that might otherwiſe enſue from the waſte, or undue diſtribution of its matter, and the conſequent alteration of its gravitation, might be prevented.

To different ſyſtems, according to their ſituations, the expanſe may exhibit very different phenomena. Although to our ſyſtem, or to us on this planet, it exhibits the blue concave of an all-ſurrounding orb; which, in the milky way, and in ſome other parts of it, ſhines with a brighter light, it may to other ſyſtems appear of other colours; and exhibit to ſome of them in ſucceſſion, according to their ſituations, the ſeveral primitive colours, in the order, in which the rays of thoſe colours are ſeparated and claſſed.

Of one of theſe exhibitions, that of the blue colour, we have ocular demonſtration. But why ſhould the expanſe appear to us blue, rather than green, or any other primitive colour? If that appearance can be explained by the refrangibility of light, or by the ſeparation of it into its ſeveral colours, as perhaps it can, the other appearances of the expanſe to other ſyſtems, naturally, if not neceſſarily, follow.

Experiments prove, that light is compounded of differently-coloured rays; and that after it has paſt through different mediums, properly diſpoſed, the rays are refracted, or ſeparated and claſſed, according to their different refrangibility; and ſhew thoſe colours in the order juſt mentioned: that the three moſt refrangible of them, the blue, the indigo, and the violet, which poſſeſs one half of the ſpace ſpread over by the whole, are ſo nearly allied in colour, that the laſt when conſiderably ſpread, are ſcarcely to be diſtinguiſhed from the neighbouring blue: for which reaſon, thoſe three claſſes appear as one, at a great diſtance from the refracting medium: and the blue, thus circumſtanced, and uniting thoſe claſſes, may therefore be ſaid to poſſeſs a ſpace equal to the ſpace occupied by all the reſt. That from any ſegment of a hollow ſphere, ſuch, for inſtance, as a concave mirror, whoſe arc does not exceed fifteen or eighteen * degrees; the cylinder of rays falling upon it, parallel to its axis, will, if there be no refraction, be reflected to a focus round that axis: the focus being nearly equidiſtant from the pole of the ſegment, and the centre of its ſphere: and that thoſe rays, if previouſly refracted, and claſſed into their ſeveral colours, will, in their divergence from the focal point, ſhew thoſe colours in a reverſed order: the refraction, however, occaſioning an alteration in the poſition of the focus, and the diverging cone.

To apply ſome of theſe obſervations, it may be ſuppoſed that the

NOTE.

* Graveſande's Natural Philoſophy, Book III. ch. xv. prop. 813,

interior ſide of the expanſe has, in general, an uniform ſurface, which may be conceived as compoſed of a multitude of ſegments, each of them not exceeding a given arch: that it is furniſhed with an atmoſphere, poſſeſſing, in ſome peculiar mode, the power of refracting light, of diſtributing its rays into their reſpective claſſes, and tranſmitting them to the expanſe: which alſo may be conceived as aſſiſting, by its reflecting power, in their claſſification: that the tranſmitted rays would, in their claſſed ſtate, be reflected from it in all directions; and that ſuch of them (by far the greateſt † part of the whole) as ſhould come to the atmoſphere in parallel lines or in cylinders, whoſe axes were diameter-lines of the expanſe, and whoſe baſes were equal to thoſe ſegments, would paſs through the atmoſphere to the correſponding ſegments of the expanſe, and be reflected from them; and afterwards, in the ſame claſſed ſtate, unite in a focus, from which they would diverge, and exhibit their ſeveral colours.

To give ſome idea, though an imperfect one, of that focus, the reflexion and convergence may be conceived as made (ſomewhat in the manner above repreſented) from the ſegments compoſing the whole ſurface of the expanſe: that each ſegment would reflect a cone of rays, terminating in a focus; and that the united foci of thoſe cones, which muſt be conſidered as coming from all quarters of the expanſe, would conſtitute its general focus.

In ſome ſuch diſpoſition, and ſtate of things, as here repreſented, it is conceivable, that the ſyſtem-light, tranſmitted to the expanſe through its atmoſphere, might be reflected from thoſe ſegments; and for the moſt part converge in cones towards a general focus; where, by means of the refraction and ſeparation, it had undergone in that tranſmiſſion and reflexion, it would be, in each cone, arranged or claſſed, according to the different refrangibility and reflexibility of its rays. After the rays had paſt the boundary of their focus, they would interſect each other, and form new and reverſed cones, or conic figures, in which each ſort of the coloured rays, as before the interſection, would generally be together; and in that aſſociated ſtate, continually diverge, in proportion to their diſtance from the line of interſection.

But perhaps the whole of this effect, the claſſification of the rays, may be cauſed by the reflecting

NOTE.

† That theſe parallel rays (parallel, I mean, to any and every conceivable diameter-line of the expanſe) muſt conſtitute the greateſt quantity or proportion of the reflected light, will be manifeſt from theſe conſiderations: that they come to every ſegment or part of the expanſe from the oppoſite part of it, and from the ſyſtems ſituated between ſuch oppoſite parts: that the diſtance of any two oppoſite parts from each other, equal to the diameter of the expanſe, is the greateſt that can take place within it: that there muſt, therefore, be, in the ſpace between them, a greater number of ſyſtems ſupplying the expanſe with light, than there can be in any extra-central direction; and that this may be affirmed of every two oppoſite parts or ſegments in the whole ſurface of the expanſe. The effect of the atmoſphere, in regard to the refraction, is not here noticed. Theſe rays, like the ſun's rays at the earth, are conſidered as parallel, by reaſon of the great diſtance of the radiant bodies, and the conſequent extreme minuteneſs of the angle of divergence at ſuch a diſtance.

power of the expanſe: which, in that caſe, would receive the rays in the ſame mixed ſtate, as the direct ſolar light comes to the earth: with reſpect to which, we know, that it frequently undergoes a claſſification by reflexion, as well as by refraction.

In either caſe, as the three moſt refrangible and reflexible claſſes, at a proper diſtance from the focus, are not to be diſtinguiſhed from each other, but all appear blue; and as the blue, at that diſtance and beyond it, doth therefore poſſeſs ſo large a portion of the interior ſpace of the expanſe, it is conceivable, that many ſyſtems may be ſo placed, as to be on all ſides in the direction of the rays of that colour; and to which the whole expanſe would, for that reaſon, appear blue.

With reſpect to the earth, it is probably ſo ſituated, as to be in all parts of its orbit, principally within the limits of ſuch claſſes, as are compoſed of the blue rays; and partly within the verge of claſſes, whoſe rays, by reaſon of their imperfect ſeparation, being in a mixed ſtate, exhibit a brighter light. The predominant colour, therefore, of the expanſe, as it reſpects the earth, is blue; with interſperſions of a brighter light, ſuch as the Milky Way, and other lucid parts of the expanſe: whoſe irregular appearance, in the Milky Way, may be owing (as hath been already ſuggeſted,) to the particular conſtruction and configuration of its parts: the brightneſs of which ſeems to intimate ſome peculiarity in their conſtitution, and in the circumſtances attending them—nature thus exhibiting, on a broad ſcale, phenomena, which our little experiments can exhibit only in miniature; and of which thoſe experiments ſometimes lead to a happy explanation.

Whether the foregoing be ſuch an explanation, or wholly chimerical, in reference to the colour of the expanſe, does not affect the expanſe itſelf: whoſe exiſtence, conſidered as an all-ſurrounding orb, may be real, although the aſſigned cauſe of its colour be demonſtrably without foundation.

From the ſeveral phenomena above-mentioned, unleſs the evidence, ſuppoſed to ariſe from them, be futile, or inadmiſſible, there is reaſon to conclude, that an all-ſurrounding orb doth really exiſt; and that the blue expanſe is that orb.

It is an obſervation of ſir Iſaac Newton, "that the main buſineſs of natural philoſophy, is to argue from phenomena, without feigning hypotheſes; and to deduce cauſes from effects, till we come to the very firſt cauſe, which certainly is not mechanical; and not only to unfold the mechaniſm of the world, but chiefly (among others that are mentioned) to reſolve theſe, and ſuch like queſtions, viz. Whence is it, that the ſun and planets gravitate towards one another, without denſe matter between them? and what hinders the fixed ſtars from falling upon one another?"*

Agreeably to the foregoing obſervation, the author of this memoir having adduced certain phenomena—(he hopes not impertinently)—has endeavoured, not only to argue from them, and to deduce the cauſe from the effects, but to reſolve that great queſtion, concerning the fixed ſtars and the heavenly bodies in general, namely, What hinders them from falling upon one another, and thereby involving the whole in ruin?—Whether his endeavours have been ſucceſsfully applied, thoſe who are converſant in ſubjects of this nature, are beſt qualified to judge.

NOTE.

* Optics, p. 344. 4th edit. 8vo.

In regard to the ſubject in hand, there ſeems to be a happy co incidence between phenomena and ſcripture; and, therefore, in further evidence of ſuch an orb, and in evidence of ſeveral other orbs ſimilar, and concentric to it, we may recur to ſcripture; ſeveral paſſages of which appear applicable to that purpoſe.

It ſeldom happens, that natural philoſophy is made to borrow aſſiſtance from thence: but though ſcripture may not be intended to inſtruct us in the philoſophy of material nature, it may nevertheleſs give, and be intended to give, ſome hints of its conſtitution, or general ſyſtem.

As the paſſages referred to, do not need any laboured comments, a very few obſervations will ſuffice to explain and apply them.

A remarkable one, and which may ſerve, in ſome meaſure, to elucidate the reſt, is this paſſage, "It is God that buildeth his ſtories in the heavens."* In the Engliſh tranſlation, which agrees with the French, with the Latin of Caſtellio, and of Tremellius and Junius, the marginal reading, referring to ſtories, is ſpheres and aſcenſions. The former explanatory of ſtories: the latter, another word for the Hebrew; and which anſwers to the Greek of the Septuagint. All which, both ſeparately and together, give the idea of a ſucceſſion of concentric ſpheres, extending one above another, like the ſtories of a magnificent building: and, agreeably to that idea, though on very different principles, perhaps not unlike of the Ptolemean ſyſtem, the text has been explained.†

NOTES.

* Amos, ch. ix. 6.

† Qui ædificat in cœlo (in fumis cœlis) aſcenſiones ſuas—ſphæras ſuas—gradus ſuos: i. e. orbes cœleſtes, qui ſunt velut gradus, unus ſupra alterum.

Poli ſynopſis in loc.

This conſtruction, which appears to be a natural one, gives a meaning to the text—a meaning illuſtrative of the omnipotence of the architect: and, at the ſame time that it elucidates ſome other texts relative to the ſubject, it is perfectly deſcriptive of the concentric ſpheres, or orbs, above mentioned.

The ſame idea is intimated in the ſhort account, given of the creation, by Moſes, who ſeems to refer to two firmaments.—The firſt he mentions, is limited to the earth and its atmoſphere; and the other is that in which the fixed ſtars do appear.

It is this latter, that is here to be conſidered: concerning which, "God ſaid, let there be lights in the firmament of heaven;" and concerning which, it is declared, that "God ſet thoſe lights in the firmament."‡

NOTES.

‡ Gen. ch. i. v. 14. 17.

Mr. Whiſton, whoſe explanation of the Moſaic account of the creation, is natural, and in general ſeems to be juſt, make no diſtinction of firmaments; which, however, he might have made, without injuring his theory; and which his own rules of interpretation would have juſtified.

The upper firmament, or the blue expanſe, in which the heavenly bodies were "ſet," he might have included, together with them, in the work of the fourth day, or year, as it was *rendered* viſible at the ſame time, by means of the earth's atmoſphere, in that year, becoming tranſparent: which atmoſphere, according to his theory, is the [other] firmament, or expanſe. He ſuppoſes, the earth had no rotation about

The radix of the Hebrew word, translated firmament, is applied to God's spreading out the sky, to the firmament, or spacious extension, which is spread abroad between the earth and the clouds: as also to that other firmament, or spacious extension, which is above the clouds, where the heavenly bodies are placed.*

The original word † means not only firmament, but expanse, or spacious extension. In the English translation, and also in the Greek of the Septuagint, it conveys the idea of something firm and solid. Some other translations adopt the other acceptation of it. It seems to include both; and, in that case, means something solid and spaciously extended.

This explication of the term, connected with the appearance of this firmament, or expanse, gives us the intimation of a solid and spaciously extended orb, or sphere: and answers to one of the stories, which God built in the heavens.

"The heavens ‡ declare the glory of God: and the firmament sheweth his handy-work."—Here is a clear distinction between the heavens and the firmament. By the former, are meant the heavenly bodies; and by the latter, the firmament, or expanse, in which they appear.

The same observations may be applied to this, as have been applied to the foregoing passage.

Another, and more descriptive of such an orb, is the following one: "hast thou spread out the sky, which is strong, and as a molten looking-glass?" ‖ or, as a mirror made of polished metal. The forementiond French and Latin versions, and the Greek of the Septuagint, do, in this passage, all concur with the English, in representing the sky, as strong, firm, and solid. The Septuagint, especially, expresses this idea with peculiar force; as doth also the Hebrew original; which, in this place, compares the sky to a speculum, or mirror, "made of polished metal."¶

"The elegant simile of the mirror cannot be understood, without recollecting, that the mirrors of the ancients were made of metal highly polished."§

This description shews the sky to be not only firm and solid, but remarkably adapted to reflect light;

NOTES.

its axis, until the deluge; and, therefore, that its annual revolution round the sun, would occasion the antediluvian day to be exactly commensurate with the year.

* Taylor's Hebrew concordance, root 1826.

† The author of this memoir, being unacquainted with Hebrew, speaks of its meaning, from information only.

‡ Psalm xix. 1. Cœlum hoc stelliferum. Poli Syn.

‖ Job xxxvii, 18. An expandisti cum eo (eum adjuvando) æthera, vel cœlos, vel firmamentum? Hoc Græci vocant stereoma, quod firmum sit, et sua se velut virtute contineat, nulla re nixum. Æthera, vel cœlos——qui solidissimi—qui sunt fortes; item, sicut speculum, fusum sive concretum.—Cœlos, quibus firmitas tribuitur, Prov. viii. 28. unde poetæ cœlum vocarunt chalkeon ouranon. "Specula fusa" intellige ex ære vel chalybe. Vox "fortes" soliditatem denotat--Cœlum—solidissimum, ut simul cohæreat. Poli Syn.

¶ Fusum, firmum, validum, instar fusi et consistentis metalli. Taylor's Hebrew concordance, root 783, 26.

§ Scott's Book of Job, page 354.

and ſo far intimates the cauſe, why it is viſible. The ſky here, as the firmament in a former clauſe, correſponds to one of the ſtories, which God built in the heavens.

There are other paſſages, which mention the ſpreading out, and ſtretching out, of the heavens; and this as declarative of the diſcretion, the underſtanding, the wiſdom and power of God. But if it be a mere appearance, ariſing from the atmoſphere-vapours, in a particular ſtate, reflecting to us the blue rays of light; or if it be a mere circumſtance attendant on, or reſulting from, the atmoſphere; and doth not indicate the real exiſtence of what is declared to be thus ſpread or ſtretched out, it is then in a comparative view, but an inferior inſtance of wiſdom and power: by no means ſuch an inſtance of them as to entitle it to be mentioned in the climax, in which it is found—much leſs to be the head or principal member of it.

The following, which is one of thoſe paſſages, and in the ſenſe of which the aforenamed verſions concur with the Engliſh, will ſhew the climax—"He hath made the earth by his power: he hath eſtabliſhed the world by his wiſdom; and hath ſtretched out the heavens by his underſtanding."* —The earth, including its atmoſphere—the world, or heavenly bodies collectively—the ſtretched-out heavens, or blue expanſe. This remarkable climax, aſcending in dignity and importance, ſhews, that the laſt and principal member of it, the expanſe, is not only diſtinct from the earth, and the whole ſyſtem of the heavenly bodies, but that it ſurpaſſes them in excellence; and that it is the capital, among the works of the viſible creation. The deſcription of it, and its rank in the climax, indicate, that it is the ſame firmament or expanſe, above deſcribed; that the ſame obſervations are applicable to it; and therefore, that this, and the parallel paſſages alluded to, may be adduced in further evidence of its exiſtence; and, conſequently, of the exiſtence of an all-ſurrounding orb.

The ſame idea is held forth in a part of the addreſs of Wiſdom in Prov. viii. 27—29: the ſenſe of which may be expreſſed in the following tranſlation: which differs from the common Engliſh tranſlation, no further than the apprehended ſenſe of the text makes neceſſary. A few explanatory notes are interſperſed by way of illuſtration.

Wiſdom ſpeaking, ſays,—verſe 27, "When God prepared the heavens [the whole ſyſtem of viſible nature] I was preſent. When (with reſpect to the heaven) he ſet an orb around the ſuperficies of the depth [the immenſe ſpace included within the orb: in reference to which, that ſpace may be juſtly called the depth]: v. 28. When he gave ſolidity and ſtrength to (that orb) the ſky above; and when he eſtabliſhed its fountains of waters [its interior and exterior atmoſpheres]: v. 29. When (with reſpect to the terraqueous globe) he gave to the ſea his decree, that its waters ſhould not paſs their bounds: and when he appointed the foundations of the earth, then I was by him."

If this tranſlation and illuſtration, be juſt, the text, which only gives the great out-lines, or capital parts of creation, ſtrongly impreſſes the idea, that there is an orb ſurrounding all viſible nature; that it is ſtrong and ſolid: and that it is furniſhed with an interior and exterior atmoſphere; all which is further deſcriptive of one of the ſtories, that God built in the heavens.

NOTE.

* Jer. ch. I. ver. 15.

In support of the translation and illustration here given, I had collected, in a marginal note, a number of authorities from Pool's synopsis: but it being somewhat long, and those who are qualified to judge in the matter, being able to recur to the synopsis, it is omitted.

Beside those authorities, and in further support of the translation, may be adduced the 148th psalm: where are enumerated, in a regular succession, the heavenly bodies, which compose the material system:—the sun, moon, stars, heavens, and waters above the heavens.

The distinct notice there taken of those bodies, and the arrangement of them according to nature, make it probable, that by the heavens (in that passage as in some others) are intended the orbs, that have been described. And, in regard to the waters above the heavens, they do plainly intimate, that those orbs are each, like the earth, environed by an atmosphere replenished with waters, to answer the same purposes with the atmospheric waters of the earth.—Of that passage, there will presently be occasion to take some further notice.

If some happy genius, well versed in Hebrew, and the philosophy of nature, would arrange in due order and faithfully translate, those parts of scripture, that in any respect refer to the constitution and economy of nature, and this with a view of reconciling them to nature, we should probably find, that scripture philosophy and natural philosophy would mutually illustrate each other. Such a translation and illustration would be a real acquisition to science; and might lead to discoveries, of which at present we can form no idea.

One quotation more, amidst a further number that might be offered, will close the evidence.

"The heaven, and the heaven of heavens, and the earth also, are the Lord's." "Thou hast made heaven, the heaven of heavens, with all their hosts: the earth, and the seas, and all things in them." "Praise him, ye sun and moon, ye stars, ye heavens of heavens, and ye waters above the heavens."*

There are other passages of like import: but these containing all the varieties of expression I have observed concerning the material heavens, or system of nature, may be thought sufficient.

That the material heavens are here intended, there can be no room to doubt, as they are mentioned in connexion with the earth—with their hosts—with the earth and seas, and the things contained in them—with the sun, moon, and stars—and with the waters above the heavens. They are evidently considered here as forming, in conjunction with those other bodies, one vast system; whose several constituent parts are, in the last clause of the quoted text, ranged in the order, in which it is natural to speak of them; and in which, reckoning from the centre of our solar system, they do in reality exist.

Here is a plain discrimination between the heaven; the heaven of heavens; and the heavens of heavens: which must imply some essential difference between them. To suppose the contrary is to confound language and involve it in uncertainty. It would be to suppose those expressions void of meaning; and would be treating scripture with the indecency to which no other book, appearing to be dictated merely by common sense, would be entitled. The expressions, then, necessarily imply some essential difference in the objects of them: and what that differen

NOTE.

* Deut. x. 14. Neh. ix. 6. Ps. cxlviii. 3. 4.

is, the quotation from Amos points out. The gradation, reſpecting the heavens, is remarkable; and, without recurring to any thing elſe, ſuggeſts the idea of ſtories in them, or beyond the orb, as above explained. The ſeries too, in which they are mentioned—the ſun, moon, ſtars, heavens, and waters above the heavens—and the place they hold in the ſeries, ſuggeſt the ſame idea, which is ſtrengthened and confirmed by the expreſs declaration, that in fact there were ſuch ſtories built by the Almighty: or, as it is otherwiſe expreſſed, that "he made them with all their hoſts."

The laſt member of the ſeries, is the waters above the heavens. Theſe waters, if we argue from analogy, ſeem to indicate and to be deſcriptive of atmoſpheres, that ſurround thoſe orbs, amply provided, like our atmoſphere, with waters, and other elements, proper for the ſupport of animal and vegetable life; and for other important purpoſes.

The number of thoſe ſtories, or concentric orbs, ſeems indefinite. The gradation clearly denotes a plurality of them; each having its hoſt—its ſuns, and planets, or ſyſtems. The ample ſpaces between them, (like the ſpace infolded by the orb, to which we more immediately belong) are beautified by thoſe glorious bodies, which, within each of the orbs, conſtitute ſyſtems innumerable, ſerving the like noble purpoſes, which our ſolar ſyſtem is calculated to ſerve, and doth ſerve.

The foregoing paſſages of ſcripture, thus interpreted, appear to agree, in their reſult, with the phenomena above mentioned; and, like them, to be naturally, and without force, applicable to the purpoſe, for which they were produced. Such agreement, it is apprehended, ſhews the propriety and fitneſs of the interpretation: as, on the other hand, a diſagreement with phenomena would prove the unfitneſs or falſity of any interpretation; and manifeſt it to be totally inadmiſſible.

When ſcripture and phenomena thus agree, they mutually elucidate each other; and in that caſe, what is deducible from the one, is confirmed by the other. As, therefore, thoſe paſſages agree with the phenomena, they both together corroborate the evidence, which each afforded ſeparately, of the exiſtence of an interior orb.

With reſpect to the exterior orbs, the evidence for them muſt reſt on ſcripture. There can be no phenomena, from which to deduce their reality; unleſs the aperture, or gap abovementioned, with what it diſcloſes, be admitted as ſuch.

The phenomena, exhibited thro' the aperture, are indeed remarkable; and may indicate an exterior orb, or the bright region between that and the orb, which more immediately ſurrounds us: in which bright region, as well as in ſome other of the lucid ſpaces in the expanſe, there ſeems to be an uninterrupted and perpetual day.

If, in fact, there be ſuch an aperture, the ſame appearances with thoſe from which it was deduced, may indicate other apertures in the other lucid ſpaces, and in the Milky Way: to the aſcertaining of which, the obſervations of the ingenious mr. Herſchell, with his large magnifiers, ſhould he think proper to apply them to that purpoſe, might happily conduce.

Among the purpoſes, for which thoſe apertures were intended, if they really exiſt, this may be one—to give the intra-orbic and tranſ-orbic ſyſtems ſome intimation of each other, and of their mutual relation; and to afford them a glimpſe of the grand, complicated ſyſtem, of which they are parts.

The immenſity of thoſe orbs, doth not invalidate their exiſtence: on the

contrary, immenſity is ſo congenial to our ideas of the Creator, and his works, that it affords, as applied to thoſe orbs, an internal preſumptive proof of their reality.

On the ſuppoſition of their exiſtence, what an aſſemblage of glorious bodies do they exhibit—peopled by an unlimited variety of beings—and arranged in a gradation beautiful and aſtoniſhing! Trace the gradation, from the ſmaller to the larger planets, circling around their ſun, and with him forming a magnificent ſyſtem! Trace it from that ſyſtem, through ſucceſſive ſyſtems, to their ſurrounding orb! Trace it from orb to orb, and through their ſeveral hoſts of ſyſtems, up to the ſuperior orb, and its ambient atmoſphere! Trace it in every poſſible direction, from the common centre to the utmoſt verge of that atmoſphere, and the moſt wonderful phenomena, in a rapture-inſpiring ſucceſſion, ſtrike the mental eye!—impreſſing the idea of a complete whole, ſelf-balanced, and held in union by univerſal gravitation!—exhibiting a ſuperlatively grand ſyſtem of ſyſtems, emboſomed in the infinite, all-comprehending eſſence of the Creator!

Grand and magnificent as this ſyſtem is, there may be another, incomparably more ſo, compoſed of myriads of ſuch ſyſtems, governed by the ſame laws, and, with it, ſurrounded by an immenſe orb, to counterbalance the gravitation of the included ſyſtems.

That other ſyſtem may be a part of a ſtill more ſplendid one, formed on the ſame plan; and this latter may enter into the compoſition of other ſyſtems, beyond compariſon ſuperior to it; each ſucceeding ſyſtem, in a regular progreſſion, riſing in dignity and ſplendor. And thus we may go on, enlarging our idea of thoſe ſyſtems, indefinitely.

What is there, to check that idea, when we conſider the infinity of ſpace, in connexion with the infinite wiſdom, power, and benevolence of the author of nature—and, at the ſame time, reflect, that infinite ſpace is the proper and only adequate theatre, for the diſplay of thoſe perfections, and of ſuch a character?

This hypotheſis, by introducing ſolid orbs, may poſſibly, on a ſuperficial view of it, be thought a revival of the ancient or Ptolemæan ſyſtem, and to grow out of it. But on the contrary, it will be found, upon examination, totally inconſiſtent with it; and to be, in reality, the offspring of the new philoſophy; derived from the grand principle of that philoſophy—univerſal gravitation.

Upon the whole—the hypotheſis, ſo far as it relates to the exiſtence of the interior orb, immediately ſurrounding the viſible heavens, the author of it apprehends to be a probable deduction from the principles of gravitation; and to be deducible alſo from phenomena, and ſcripture. He offers it for conſideration, with the hope, that, if it ſhould appear not wholly groundleſs, it may be productive of a happier illuſtration.

A theory of lightning, and thunder-ſtorms, by Andrew Oliver eſq. of Salem in the ſtate of Maſſachuſetts.

IT has been generally, and, conſidering the phenomena themſelves, very naturally, ſuppoſed, that the electric charges, which are exhibited in repeated flaſhes of lightning during a thunder ſtorm, are previouſly accumulated in the vapours which conſtitute the cloud; and that theſe vapours, when by any means they become either over-charged with electric matter, or are deprived of their

natural quantities of it*, diſcharge their ſurpluſage to, or receive the neceſſary ſupplies from, either the earth or the neighbouring clouds, in ſucceſſive exploſions, till an equilibrium is reſtored between them. But I ſhall endeavour, in the following pages, to prove, that theſe charges reſide, not in the cloud, or vapours of which it conſiſts, but in the air which ſuſtains them—and that, previous to the formation of the cloud, or even the aſcent of the vapours of which it is formed. But in order to convey my ideas, upon this ſubject, with perſpicuity, I find it neceſſary to introduce them with a quotation from dr. Franklin's letters on electricity, in which the doctor compares water, whether in its natural ſtate, or rarefied into vapours, to a ſponge; and the electric fluid, in connexion with it, to water applied to the ſponge.

"When a ſponge, ſays he, is ſomewhat condenſed, by being ſqueezed between the fingers, it will not receive and retain ſo much water, as when it is in its more looſe and open ſtate, If more ſqueezed and condenſed, ſome of the water will come out of its inner parts, and flow on the ſurface. If the preſſure of the fingers be entirely removed, the ſponge will not only reſume what was lately forced out, but attract an additional quantity. As the ſponge, in its rarer ſtate, will naturally attract and abſorb more water—and, in its denſer ſtate, will naturally attract and abſorb leſs water—we may call the quantity it abſorbs in either ſtate, its natural quantity, the ſtate being conſidered."

NOTE.

* A body is ſaid to be electrically charged, whenever it has either more or leſs than its natural quantity of electric matter.

The doctor then ſuppoſes "that what the ſponge is to water, the ſame is water to the electric fluid;—that, when a portion of water is in its common denſe ſtate, it can hold no more electric fluid, than it has; if any be added, it ſpreads upon the ſurface." He adds, "when the ſame portion of water is rarefied into vapour, and forms a cloud, it is then capable of receiving and abſorbing a much greater quantity, as there is room for each particle to have an electric atmoſphere. Thus water, in its rarefied ſtate, or in the form of a cloud, will be in a negative ſtate of electricity; it will have leſs than its natural quantity, that is, leſs than it is naturally capable of attracting and abſorbing in that ſtate*."

The foregoing paſſages I have copied *verbatim* from that celebrated electrician; as I purpoſe, in the courſe of this eſſay, to avail myſelf of his idea of the ſponge, in order to illuſtrate a different theory of thunder clouds, which I now beg leave, (though with diffidence of my own judgment, and with all due deference to that of ſo great a man) to ſubſtitute in the room of the foregoing; which, I muſt confeſs, at firſt ſight, carries great appearance of probability with it, and is highly corroborated by the curious and beautiful experiment the doctor made with the ſilver can, braſs chain, and lock of cotton†.

But in reading doctor Prieſtley's hiſtory of electricity, ſome thoughts of Signor Beccaria occurred, which ſatisfied me, that this hypotheſis, however ingenious and plauſible, was inſufficient for the purpoſe of accounting for the riſe and pheno-

NOTE.

* Franklin's letters, page 119.
† Page 121.

mena of thunder ſtorms; the frequent extent, and violence of which, ſeem to require a more general cauſe, than that hinted above, to ſupply them with ſufficient quantities of electric matter.

" Conſidering the vaſt quantity of " electric fire, that appears in the " moſt ſimple thunder ſtorms, " ſays " doctor Prieſtley‡," Signor Beccaria " thinks it impoſſible, that any cloud, " or number of clouds, ſhould ever " contain it all, ſo as either to diſ- " charge or receive it. Beſides, du- " ring the progreſs and increaſe of the " ſtorm, though the lightning fre- " quently ſtruck to the earth, the " ſame clouds were the next moment " ready to make a ſtill greater diſ- " charge, and his apparatus continu- " ed to be as much affected as ever. " The clouds muſt conſequently have " received, at one place, the mo- " ment that a diſcharge was made " from them in another.

Signor Beccaria accounts for this vaſt exhibition of electric fire from a thunder cloud, by ſuppoſing, that ſome parts of the earth may become more highly charged with the electric fluid than others, and that great quantities of it do ſometimes ruſh out of particular parts, and riſe through the air, into the higher regions of the atmoſphere; other parts of the earth becoming caſually deſtitute of their natural quantity of the fluid at the ſame time, and ready to receive it: that a chain of clouds nearly contiguous, or a ſingle cloud, extending from one of theſe regions to another, in an oppoſite ſtate, might ſerve as a conductor or conductors, to reſtore the electric equilibrium between them, which would equally cauſe thunder and lightning in both regions, and throughout the intermediate clouds*. Here doctor Prieſtley juſtly obſerves, that " the " greateſt difficulty, attending this " theory of the origin of thunder " ſtorms, relates to the collection and " inſulation of electric matter, within " the body of the earth." With regard to the collection, the doctor obſerves, that his author " has nothing " particular to ſay:" nor indeed, without a previous inſulation of thoſe parts of the earth, which may be concerned in the production of the phenomena, can any ſuch collection take place. Now if we conſider, that, in order to have two regions of the earth thus inſulated, and of ſufficient dimenſions, one to ſupply, and the other to receive the quantities of electric fire, diſcharged during one thunder ſtorm of any extent and continuance, the parts inſulated muſt not be ſuperficial regions, but muſt reach to a conſiderable depth; we muſt ſuppoſe, with doctor Prieſtley, " that the " electric matter, which forms and " animates the thunder cloud, iſſues " from places far below the ſur- " face of the earth, and that it bu- " ries itſelf there†." But, with deference to the judgment of that unwearied friend to ſcience, I apprehend, that ſuch an inſulation is hardly conſiſtent with that diſtribution of conductors, eſpecially of water, which provident nature has made through all parts of our globe; the higheſt mountains being furniſhed with internal ſprings and fountains, and watered externally by rivulets, which derive their origin from condenſing miſts or melting ſnows upon their ſummits: while the ſurface of the earth in general, not excepting the moſt ſandy deſerts, affords ſupplies of water, to thoſe who will be

NOTE.

‡ Prieſtley's hiſtory of electricity, page 325.

NOTES.

* ibid.

† Prieſtley, page 335.

at the pains of digging for it. If then the vapours, which conſtitute the cloud, are, of themſelves, incapable of furniſhing ſuch quantities of electric matter as are neceſſary for the repeated diſcharges in a ſevere thunder ſtorm, as Signor Beccaria thinks they are, and as ſeems to me indubitable; and if the inſulations of large portions of the ſurface or exterior parts of the earth, which are abſolutely neceſſary to ſupport Beccaria's hypotheſis, cannot take place; and, how they can in our terraqueous maſs, is difficult to conceive, conſiſtently with the hitherto diſcovered properties of the electric fluid) we muſt ſeek for ſome other ſubſtance in nature, which may be capable of affording thoſe reiterated ſupplies of that powerful element, which are uſually exhibited in a thunder ſtorm. This, I preſume, we ſhall find is the atmoſphere over our heads; not in the vapours which float therein, but in the air itſelf which ſuſtains them.

Air is by electricians juſtly claſſed with electric ſubſtances, as it poſſeſſes the ſame general properties, in common with others of that denomination, particular inſtances of which may occur in the following pages; wherein I ſhall endeavour to prove,

I. That the electric capacity of air is leſſened by condenſation.

II. That this capacity is increaſed by heat.

Premiſing, that by air I here mean that fluid in its common compreſſed ſtate, with us, near the ſurface of the earth; and by its electric capacity, that ſtate of it, which diſpoſes it under any circumſtances whatever, "to attract, abſorb and retain," what doctor Franklin calls its natural quantity, or the quantity which is natural to it in that ſtate.

I. I ſhall endeavour to prove, that the electric capacity of air is leſſened by condenſation.

That a change of denſity in air produces alſo a change in its electric capacity (as above defined,) follows from ſome experiments of monſieur de Faye and doctor Prieſtley, the former of whom found, upon repeated trials, that no electricity could be excited by the friction of a glaſs tube, in which the air was condenſed*. The doctor, repeating the experiments with ſome variation, found, that, when one additional atmoſphere was forced into the tube, the electricity, excited by rubbing it, was ſcarcely diſcernible. Now, though the effect was a ſuſpenſion of the operation of the excited tube without, the cauſe was evidently the condenſed ſtate of the air within; which may be accounted for, if we conſider, that, although it is certain, from many experiments, that glaſs is abſolutely impermeable to the electric fluid, inſomuch that it cannot force its way through a pane of glaſs, or the ſides of a phial, without breaking the glaſs, (as was the caſe in thoſe ſpontaneous diſcharges of ſeveral of the jars in the electrical battery mentioned by doctor Prieſtley†) yet it is as certain, that this impermeability of the glaſs to the fluid itſelf, is no obſtruction to the operation of that repellent power, upon which the viſible effects of this element ſeem principally to depend; which power undeniably acts from one ſide of the glaſs, through the very ſubſtance of it, upon the ſame fluid on the other ſide, provided there be any other ſubſtance on that ſide, capable of receiving it, when thus repelled.

This is the caſe in the Leyden experiment, in every form, in which it can be made; the charge given to one ſide of the glaſs, repelling and throwing off an equal quantity of the

* Page 50. † Page 489.

electric fluid from the oppoſite ſurface, through the non-electric coating, in contact with it; nor can any charge be given to either ſide, without a proportional diſcharge from the other. In like manner, when an uncoated tube is excited by friction, a quantity of the fluid, equal to that which is excited and condenſed upon the outer ſurface, is thrown out from the inner, provided there is any ſubſtance within, in a capacity to receive and abſorb it, without which no excitation can take place, "A "glaſs tube, out of which the air is "exhauſted, diſcovers no ſigns of e-"lectricity outwards*;" there being no ſubſtance within capable of receiving and abſorbing the fluid from the inner ſurface, which, though repelled from it inwards during the operation, yet returns to it again inſtantly, upon a ceſſation of the action of the rubber without. But upon a readmiſſion of air, the excitation is eaſy, and is attended with the uſual effects. Air, then, which is the only ſubſtance admitted (excepting perhaps a few ſtraggling vapours which float in it) receives and abſorbs a ſufficient quantity of the electric fluid from the inner ſurface, to permit an excitation of the tube, which contains it. But as we have ſeen, that air, when condenſed within, prevents the viſible effects of an excitation, equally with a total vacuity, we may adopt the idea of doctor Franklin, *mutatis mutandis*, and conclude, that "what the ſponge is to water, the ſame is air to the electric fluid:" at leaſt that this capacity of air is leſſened by condenſation, in a manner, not indeed perfectly ſimilar, but, ſomewhat analogous to that, in which the capacity of a ſponge, to receive and retain water, it leſſened by compreſſion. Agreeably to which idea, the condenſed air within the tube, having its electric capacity filled, and even crouded, with the electric matter, will receive none from the inner ſurface, which, on the contrary, is thereby prevented from being forced out of it; without which, none can be forced into, or condenſed upon the outer ſurface, ſo as to exhibit any ſigns of electricity; as obſerved before.

II. I ſhall endeavour to prove, that the electric capacity of air is encreaſed by heat.

This alſo appears probable, at leaſt, from the above-cited experiments of doctor Prieſtley; for, after the air, in his tube, had had this capacity ſo far diminiſhed by condenſation, as not to permit an excitation without, that capacity, together with the conſequent excitability of the tube, was reſtored, by the action of heat upon the included air, "Repeating my attempts (ſays he) to excite the tube above mentioned, I found, that, after very hard rubbing, it began to act a little, and that its virtue increaſed with the labour. Thinking it might be the warmth which produced this effect, I held the tube to the fire, and found, that, when it was pretty hot, it would act almoſt as well, as when it contained no more than its uſual quantity of air*."

In page 553, doctor Prieſtley tells us, that ſome of his electrical friends were of opinion, "that the reaſon, why a tube, with condenſed air in it, cannot be excited, is, that the denſe air within prevents the electric fluid from being forced out of the inſide of the tube, without which none can be forced into the out-

NOTE.

* Prieſtley's hiſtory of electricity, page 550.

NOTE.

* Page 551.

" ſide; and that heating the tube makes the air within leſs electrical;" that is, (as I conceive their meaning) puts it in a capacity, to receive and abſorb more of the electric fluid, than it could otherwiſe do in that condenſed ſtate. The doctor indeed aſks, by way of objection to the foregoing ſolution,—" How, upon " this principle, can a ſolid ſtick of " glaſs be excited ?' To which I would anſwer, that poſſibly, when a ſolid ſtick of glaſs is excited, as much of the electric fluid may be drawn out of one ſide of it, as is thrown into or condenſed upon the other: if ſo, although it may ſhew equal ſigns of electricity on both ſides, yet one ſide will be in a poſitive, the other in a negative ſtate; when it will exactly reſemble the curious ſtone, called the Tourmalin, by ſome *lapis electricus*, which, doctor Prieſtley ſays,* " has always, at the ſame time, a " poſitive and a negative electricity; " one of its ſides being in one ſtate, " and the other in the oppoſite;" which does not depend upon the external form " of the ſtone." But the truth of this ſolution muſt be determined by future experiments.

That the electric ſtate of the air is liable to be affected by heat, is further evident, from a courſe of experiments, which were made by the abbé Mazeas, with an apparatus, that was conſtructed ſolely with a view of determining the electricity of the atmoſphere, anno 1753†. With this apparatus, the abbé obſerved, that, from the 17th of June, when he began his experiments, the electricity of the air was ſenſibly felt every day, from ſun riſe till ſeven or eight o'clock in the evening, when the weather was dry; but that, in the drieſt nights of that ſummer he could diſcover no ſigns of electricity in the air, nor till the morning, when the ſun began to appear above the horizon; and that " they vaniſhed again " in the evening, about half an hour " after ſun-ſet;" and further " that " the ſtrongeſt common electricity " of the atmoſphere, during the " ſummer, was perceived in the " month of July, on a very dry day, " the heavens being very clear, and " the ſun extremely hot."

Now, as this electricity of the air was ſenſible only during day-light, no electricity being diſcoverable therein, even in the drieſt nights, and as the air exhibited the ſtrongeſt ſigns of electricity, when the ſun ſhone extremely hot; is not the concluſion unavoidable, that heat ſomehow affects the electric capacity of air, either enlarging it, and thereby diſpoſing the air to attract, receive and abſorb greater quantities of electric matter, than it is capable of abſorbing in its natural ſtate; or ſuperadding, to its natural quantity, more than it can abſorb, and thereby diſpoſing it to throw off the redundancy upon any objects, which may be in a ſituation to receive it? One or the other ſeems neceſſarily to follow: but the former is moſt agreeable to doctor Prieſtley's experiment of the condenſed air, in the tube above mentioned; and is perfectly conſonant with the obſervations of doctor Franklin, mr. Kinnerſley, and others, that thunder clouds are generally in the negative ſtate of electricity*. But more upon this head hereafter. I would however

NOTES.

*Page 299. † Page 342.

NOTE.

*Epitome of Phil. Tranſ. Gent. Mag. Sept. 1773, page 447. Mr. Henley thinks, that cold electrifies the atmoſphere poſitively; and thence conjectures, that heat electrifies it negatively. His concluſions are founded upon a courſe of experiments.

obſerve here, that many, and perhaps all other, electric ſubſtances, even the moſt firm and ſolid, as well as air, are liable to have their electric capacities thus diverſified by heat, more particularly the Tourmalin above mentioned. But as, in treating of the properties of this ſtone, doctor Prieſtley has thought it deſerving of a diſtinct ſection in his electric hiſtory, to that I ſhall refer the reader, for a particular account of them†; wherein he will find a diſcovery, made by meſſrs. Canton and Wilſon, that theſe properties are not peculiar to the Tourmalin, but that many gems have a natural diſpoſition to afford the ſame appearances: whence we may conclude, as above, by analogy, that all electric ſubſtances are more or leſs affected in like manner, by the ſame cauſe. But, to return to the ſubject:

If, from the foregoing conſiderations, the reader ſhould be ſatisfied, that the electric capacity of air, in its condenſed ſtate, in the lower regions of the atmoſphere, is liable to be diminiſhed by a further condenſation, and that, *cæteris paribus*, it is increaſed by heat, and *vice verſa*; the ſolution of the phenomena of thunder and lightning, to his ſatisfaction, upon electrical principles, will perhaps be no difficult taſk

For, let us conceive a region of the atmoſphere, extending over a large tract of country, to be rarefied and heated, during a hot ſummer's day, not only by the paſſage of the ſun's direct rays through it, and by the reflexion of thoſe rays from the ſurface of the earth into it; but chiefly by the communication of the heat acquired by that ſurface: the electric capacity of that region of air would be increaſed, both on account of the heat it undergoes, and of the rarefaction conſequent upon that heat: it will then have leſs than its natural quantity, or the quantity it is naturally diſpoſed to receive and abſorb in that ſtate; it will conſequently be, in the language of electricians, negatively electriſed, or in a craving ſtate, requiring and forcing ſupplies from all ſubſtances capable of affording them, provided it be itſelf in a condition to receive them. But however craving, it cannot receive thoſe ſupplies from the neighbouring regions of the atmoſphere, while thoſe regions ſeverally remain in the ſtate of pure air, (even ſuppoſing the latter to poſſeſs more than their natural quantities, and thereby as much diſpoſed to impart, as the former is to receive them) without the intervention of non-electric conductors; and that, owing to the impermeability of air, as ſuch, to the electric fluid. This I ſhall endeavour, 1. To illuſtrate by experiments made with glaſs. 2. To prove by experiments made upon air itſelf.

1. If a pane of glaſs be coated on both ſides, by the application of plates of tin to them, the glaſs may be charged in the ſame manner, as the Leyden phial: when, after the removal of the plates, (no diſcharge having previouſly taken place,) both ſides of the glaſs will remain charged, one poſitively, the other negatively; the former having more than its natural quantity, the latter being proportionably deficient, and in a craving ſtate. Theſe ſtates both ſurfaces will obſtinately maintain for a long time: nor do I know of any method of reſtoring the electric equilibrium between them, but, either to immerſe the pane in water or ſome other non-electric fluid, which will do it inſtantly, and ſilently; or to re-apply the metalline coatings to both ſides, as they were placed at firſt, with a good conductor introduced between them, which will anſwer the ſame purpoſe, and be attended with an exploſion, or ſmart

† Page 297

ſpark and ſnap; or laſtly, to place it in a ſituation where it may be expoſed to air replete with moiſt vapours, where, after ſome time, the vapours will, by condenſing upon each ſide, furniſh it with a moiſture equivalent to a non-electric coating, while the vapours, which remain in the ſurrounding air, will, by continually impinging upon, and receding from the two ſurfaces, at length reſtore both to their natural ſtate.

It is evident, from the foregoing experiment, firſt, that the charges reſide in the glaſs itſelf, as they remain after the coatings are removed. Secondly, that the oppoſite ſides have a very ſtrong propenſity, one to give, the other to receive the fluid, and thereby to reſtore the electric equilibrium between themſelves; which is done with violence, as obſerved above, when they are put in a condition of doing it by the re-application of the metalline coatings, with a conductor between them; and laſtly, that notwithſtanding the violent propenſity, in the ſide of the glaſs, to reſtore themſelves and each other to their natural electric ſtates, and the ſmall diſtance between them, they can never effect it, without the intervention of non-electric conductors.

2. I ſhall now ſhew, by other experiments, that different regions or ſtrata of air may become charged, both poſitively and negatively, in the ſame manner as the ſides of the pane of glaſs were in the foregoing; and that the effects of ſuch charges are preciſely the ſame.

Meſſrs. Wilkie and Æpinus at Berlin, having the hint naturally ſuggeſted to them, by a previous courſe of experiments, endeavoured to give the electrical ſhock by means of air, in the ſame manner, in which it may be given by glaſs; "in which, after "making ſeveral attempts," ſays dr. Prieſtley*, "they at length ſucceeded, "by ſuſpending large boards of wood, "covered with tin, with the flat ſides "towards one another, and at ſome "inches aſunder. For they found "that upon electrifying one of the "boards poſitively, the other was "always negative. But the diſco-"very was made complete and in-"diſputable, by a perſon's touching "one of the plates with one hand, "and bringing his other hand "to the other plate; for he then re-"ceived a ſhock through his body, "exactly like that of the Leyden "experiment. With this plate of "air, as we may call it, they made a "variety of experiments. The two "metal plates, being in oppoſite "ſtates, ſtrongly attracted one ano-"ther, and would have ruſhed toge-"ther if they had not been kept a-"ſunder by the ſtrings. Sometimes "the electricity of both would be "diſcharged by a ſtrong ſpark be-"tween them, as when a pane of "glaſs burſts, with too great a "charge. A finger, put between "them, promoted the diſcharge, and "felt the ſhock. If an eminence "was made on either of the plates, "the ſelf-diſcharge would always be "made through it; and a pointed "body, fixed upon either of them, "prevented their being charged at "all."

To the foregoing relation of the experiments themſelves, I ſhall ſubjoin the concluſions drawn from them, by the curious electricians who made them, in the words of doctor Prieſtley, viz. "The ſtate of theſe two "plates, they", Wilkie and Æpinus, "excellently obſerve, juſtly re-"preſents the ſtate of the clouds and "the earth" (and perhaps of diffe-

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* Page 242.

rent clouds, at various heights, one over another) " during a thunder " ſtorm; the clouds being always in " one ſtate, and the earth in the op- " poſite; while the body of air be- " tween them, anſwers the ſame pur- " poſe, as the ſmall plate of air be- " tween the boards, or the plate of " glaſs between the two metal coat- " ings, in the Leyden experiment. " The phenomenon of lightning is " the burſting of the plate of air by " a ſpontaneous diſcharge, which is " always made through eminences; " and the bodies, through which the " diſcharge is made, are violently " ſhocked."

As in the former experiment, made with the pane of glaſs, the charges both poſitive and negative, reſide in the glaſs itſelf, and not in the coatings, thoſe remaining, after theſe are removed; ſo in the latter, which is completely analogous to it, the charges are accumulated, and reſide in the air ſituated between the boards, and not in their tin linings, which ſerve only as conductors, to diſtribute the fluid equally over, or to convey it equally from, the whole ſurface of air which is limited by, and in contact with them, on either ſide; whereby the whole of each ſurface may be equally charged, at the ſame time, or diſcharged by the ſame exploſion.

If two or more regions of the atmoſphere, when free from vapours, become thus differently electrical in their ſtate and capacities, which, that they may, from the heat and conſequent rarefaction in a ſummer's day, we have already ſeen, and perhaps from a variety of other cauſes to us unknown—and if, from the contrary currents of air, which frequently take place, at different heights, they ſhould perchance become ſituated one over or adjacent to another, like ſtrata of minerals within the bowels of the earth—what the metalline coating is to the pane of glaſs, or the tinned boards to the plate of air, in the laſt experiment, the ſame would clouds formed and floating therein, be to theſe regions of air; the electric e- quilibrium between which might be reſtored through their intervention either by ſpontaneous diſcharge through the pure air between them in ſevere flaſhes of lightning, or through the falling drops of rain which in their ſucceſſive deſcent, form a chain of natural conductors between one region of the air and another and betwixt each of them and the earth; the paſſage of the electric fluid through which, would alſo be attended with lightning and thunder, but not ſo ſevere as when the diſcharge is made through the pure air; the moſt fatal lightning uſually preceding the fall of the rain.

It is not uncommon, during the riſe and progreſs of a thunder ſtorm to ſee different ſets of clouds, at various heights in the atmoſphere, moving promiſcuouſly in all directions as though they were impelled hither and thither by contending winds; when probably the whole phenomenon ariſes from the different electrical ſtates of the regions of the air, in which they float; as they approach one or other of which, they are attracted or repelled, and move accordingly, communicating, receiving or tranſmiting the electric fluid, to or from them reſpectively, as they may be either deficient of their natural quantity, or poſſeſs a redundancy of this fluid. And as in the experiment of meſſrs. Wilkie and Æpinus mentioned above, the two tin plates with the boards they covered, would have ruſhed together, had they not been kept aſunder by the ſtrings, ſo theſe clouds, floating freely in air and being at liberty to act upon every impulſe, gradually coaleſce in reſtoring the electric equilibrium of

the neighbouring atmoſphere by repeated diſcharges, as they unite*; till at length they form one denſe maſs of humid vapours, which precipitating in a heavy ſhower of rain, refreſh the thirſty ſoil, leaving the atmoſphere above in a homogenous electric ſtate, calm and ſerene.

How theſe clouds are generated, formed, and adapted to thoſe grand purpoſes in the economy of nature, is next to be conſidered: in proſecution of which enquiry, I ſhall ſubmit the following obſervations to the candour of the reader.

Whatever the immediate cauſe of evaporation may be, it is certain that the ſuperficial moiſture of all bodies is perpetually exhaling in vapours, which aſcend into the higher regions of the atmoſphere, where they gather and are formed into clouds, and at length re-condenſe, deſcending in dew, miſt, or rain upon the ſurface of the earth, from whence they ſprang.

Theſe vapours are either detached in ſtreams from the humid ground, by the influence of the ſun, or thrown off by the perſpirations of thoſe infinite multitudes of animals and plants, which cover the face of the earth†, or ſupplied by evaporation, from the ocean, or other grand collections of water.

Ignorant as we are of the nature of theſe operations, and of the manner in which they are performed, it is natural to ſuppoſe, that the vapours themſelves aſcend in the ſame electric ſtate, whether poſitive, neutral or negative, with the ſubſtances from which they ariſe. Accordingly, ſignior Beccaria, in making ſome of his experiments, obſerved, that "ſteam, riſing from an electrified "eolipile, diffuſes itſelf with the ſame "uniformity, with which thunder "clouds ſpread themſelves and ſwell "into arches, extending itſelf to-"wards any conducting ſubſtance‡." This ſtream then was electrified, as well as the eolipile, from whence it proceeded. The ſea muſt neceſſarily be ſuppoſed, in common with the whole terraqueous maſs, to contain juſt its natural quantity of the electric fluid, and no more: we may therefore conclude, that both the vapours which ariſe immediately from it, and the air which ſuſtains them, and from its ſituation enjoys a more equal temperature, than that over the land, are in the ſame electrical ſtate with the ſea itſelf, containing neither more nor leſs than their natural quantity.

Conſidering the vaſt extent of the ocean, and the comparatively ſmall degree of moiſture of which the dry land is ſuſceptible, we may conclude, that a very ſmall proportion of the clouds, which are formed in the atmoſphere are exhaled from the latter, and that the ocean is the grand ſource from whence they principally derive their origin. Our ſenſes accordingly convince us that the ſea-air is always replete with moiſt vapours, even when its natural tranſparency is not in the leaſt interrupted by them. Hence in a hot ſummer's day, when the wind ſuddenly ſhifts from weſt to eaſt, we immediately perceive a chill from the ſea-breeze; and ſometimes long before the thermometer indicates a

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*It is certain, that, in moſt thunder ſtorms, the flaſhes of lightning are chiefly diſcharged from cloud to cloud; very few, and frequently none at all taking place between the cloud and the earth.

† See Hales's vegetable ſtatics, and Chambers's Cyclopedia, under the word, perſpiration.

‡ Prieſtley's hiſtory, page 327.

change in the temperature of the atmoſphere. Theſe vapours, when they firſt ariſe from the ſea, are generally ſo nearly of the ſame denſity with the ſurrounding and contiguous air, that the rays of light, in paſſing through them, undergo no ſenſible change in their refraction; they are therefore at firſt generally inviſible; but when the weather is extremely cold, and the air, of conſequence, uncommonly denſe, they are always viſible, and appear like a ſteam ariſing from boiling water*. Not that vapours aſcend moſt copiouſly in the coldeſt ſeaſons, which ſeems contrary both to reaſon and experience; but that the different denſities of the air, next the ſurface of the water, and of the vapours which aſcend in it, render the latter viſible, by the irregular refractions of the rays of light in paſſing through them. For the ſame reaſon, our breath is viſible in the winter, but not in warm weather.

Let us now ſuppoſe the atmoſphere, on a ſummer's morning, to be all around in a homogenous ſtate, as indicated by a cloudleſs ſky and a dead calm. As the ſun riſes on the eaſtern coaſts of America, and warms and rarefies the atmoſphere eaſtward, the rarefied air naturally aſcends, and a current of air as naturally flows thither from the oppoſite quarter, which is but juſt emerging from the cool ſhades of night, to ſupply its place: the conſequence of which is a light weſterly breeze. As the ſun aſcends higher, the air over the land becomes heated and rarefied, both by the paſſage of the ſun's direct and reflected rays through it, and by the reverberation of the heat, acquired from them by the ſurface of the earth; till at length that whole region of the atmoſphere has its electrical capacity enlarged, thereby becoming negatively electriſed, or in a craving ſtate, as obſerved before. On the contrary, the ſun's rays, which fall upon the ſurface of the ſea, eſpecially when ruffled by wind, chiefly enter that tranſparent medium, in which they are refracted and irrecoverably abſorbed; very few, comparatively, being reflected; whence very little heat can be reverberated from that element to warm the incumbent air, which is ſenſibly affected only by the paſſage of the ſun's direct rays through it, unleſs the weather be calm and the ſurface very ſmooth†. Beſides, it is colder at ſea than aſhore, in the ſummer ſeaſon, when, and when only thunder ſhowers are fre-

NOTE.

* This is always the appearance in a clear, ſtill morning, when the mercury in Farenheit's thermometer is at 0, or below it.

† In a perfect calm, the ſurface of the ſea acts like a mirror upon the ſun's rays, ſtrongly reverberating them back into the atmoſphere, when the heat is as ſenſible upon water as upon the dry land. But whenever that ſurface becomes agitated and broken by the force of wind acting upon it, thoſe rays, by perpetually impinging upon an infinite variety of new formed, fluctuating ſurfaces, undergo innumerable refractions, in all directions, whereby they are abſorbed and loſt within the fluid maſs, in ſome proportion to the violence of the agitation. Accordingly, when the weather is ſerene and calm, the ſurface, like a looking-glaſs, reflects the phenomena of the ſky over head; upon the firſt ſpringing up of a breeze, it changes to a light blue, which deepens to a fine ſky-blue as the wind riſes, to a deeper ſea-green in a briſk gale, and to a ſullen blackneſs in a ſtorm, excepting where the waves are interſperſed with white heads of foam, which, by contraſt, only render the ſcene more gloomy.

quent, and indeed warmer in winter, for the following reaſon, viz. as the ſea is every moment changing its ſurface, neither heat nor cold can affect it ſo ſoon as they do the ſurface of the earth, which continues the ſame.

The air over the land, when thoroughly heated and rarefied, naturally aſcends into the higher regions, while the denſer air from the ſea, neceſſarily flows in, and takes its place. Hence, probably, the eaſterly winds which uſually ſpring up near the middle of the day, after a ſultry morning.

This body of warm air aſcends till it arrives at that region of the atmoſphere in which thunder clouds are formed; while the vapours, which are wafted to the continent by the eaſtern current, being attracted by this now ſuperior air, which demands a ſupply of the electric fluid, continually aſcend, till they arrive at it, leaving the denſer air, with which they were firſt connected, behind. As theſe vapours move freely through and mix with air, they eaſily inſinuate themſelves between the particles of that fluid, and unite with it, whereby every particle of air, which, from the cauſes aforeſaid, is become in any degree deſtitute of the quantity of electric matter which is natural to it, in its preſent ſtate, may and will attract and attach to itſelf one or more particles of this vapour, and thereby furniſh itſelf with a non-electric coating, and thus become qualified to receive from any neighbouring object ſuch a ſupply of the electric fluid, as its ſtate may demand.

Thus provided, this body of air, together with the vapours which are more or leſs attached to every particle of it, will conſtitute a denſe cloud; and as the air itſelf was before (by ſuppoſition) in a craving or negative ſtate of electricity—and as the vapours are preſumed to have ariſen from the ocean in their natural or neutral ſtate, the whole body of a cloud formed by them, will ſtill be in a negative ſtate, and thereby conſtitute a complete thunder cloud; which, when formed, if uniform in denſity and contexture, ſhould it be attracted within the ſtriking diſtance from any object ſtanding upon the earth, would have its electric equilibrium reſtored at once by a flaſh of lightning darting from the earth: or, ſhould it paſs near another cloud in a different ſtate, the flaſh would reſtore an equilibrium between the two clouds.

That a body of air, either in a poſitive or negative ſtate of electricity, while pure, ſhould be incapable of communicating its ſurpluſage of the electric element to, or receiving ſupplies from the neighbouring regions, though in a contrary ſtate—and that the ſame air, when replete with watry vapours, may be reſtored to an equilibrium throughout its whole extent, by an inſtantaneous diſcharge—may yet require ſome further evidence, before it be admitted.

But, as the particles both of air and vapour, are ſeverally too minute to fall under our notice, I ſhall endeavour to illuſtrate by analogy, what cannot be directly demonſtrated by experiment. In order to this, I ſhall firſt give a general deſcription of, and then ſubjoin ſome obſervations upon doctor Prieſtley's electrical battery.

This battery conſiſted of ſixty-four cylindrical glaſs jars, fixed in a ſquare box; the jars were coated within and without with tin foil, and the floor of the box was covered with the ſame, whereby the outſides of all the jars formed but one continued electrical ſurface. In like manner, by means of ſmall braſs bars extending over the mouths of the jars in their ſeveral ranges, and by wires, which connected the ſeveral bars, together with others which deſcended from them, communicating with the inner coating of each jar, their interi-

or ſurfaces were ſo connected, as to form, in the ſame ſenſe, but one ſurface. Thus conſtructed, the whole battery is capable of being equally charged in every part at the ſame time, and of being diſcharged throughout, by the ſame exploſion.

Here I would obſerve, that if, inſtead of the metalline coatings, the jars were filled with water to the ſame height with them, and were immerſed in the ſame order in a ſquare veſſel of water, to an equal depth, the bars and wire remaining as before, the ſucceſs of all the experiments made with them, would be the ſame as above. Let then a battery be conſtructed and charged in this form; after which, let the bars and wires aforeſaid be removed, and the water, contained in the jars, be decanted off by glaſs ſyphons, and let the water be drawn off from the veſſel in which they ſtand. It is evident, from the experiment of the charged pane of glaſs, already mentioned, and other experiments, recited in doctor Franklin's letters, that theſe jars will remain ſeverally charged, as they were jointly before. They may now, when dry, be taken out, and handled at pleaſure, with ſafety; nor can they be eaſily reſtored to their natural ſtates, but either by immerſing them ſingly under water, or by replacing the whole apparatus, and filling both the jars, and the box which contains them, with water as at firſt, and introducing a metalline conductor between the water without the jars, and any one of the wires which connect their inſides; then the whole will be inſtantly diſcharged with an exploſion*.

To apply theſe obſervations to the preſent ſubject, we may regard every particle of a body of pure†, but incidentally electrified air, in the ſame light with one of the jars in the battery aforeſaid, which, after having been charged, is deprived of its adventitious coatings: each particle, like one of thoſe jars, will retain the ſtate it may happen to be in, ſo long as it remains deſtitute of a conducting appendage. But when, and by what means ſoever, a ſufficiency of moiſt vapours ſhall become interſperſed amongſt theſe particles of air, to furniſh them ſeverally with non-electric coatings, and by the nearneſs or contiguity of theſe vapours to form a communication from one to another, throughout the whole, they will then be in the ſame connected ſtate with the jars in the battery, when complete in every part, and charged; and like thoſe jars, be the particles ever ſo numerous, they will be in a capacity of jointly receiving or communicating the electric fire. And as, by the addition of jars in the conſtruction of the battery, the exploſion at the diſcharge may be increaſed indefinitely —ſo will the violence of the exploſion from a thunder cloud, be increaſed in proportion to its extent, and to the multitude of aerial particles, together with their appendant vapours, of which it conſiſts, and which are ſo connected, as to be capable of uniting in the ſame diſcharge. But as a thunder cloud is not uſually formed at once, but by degrees, ſmaller clouds generally forming themſelves in ſeparate parties before they join the main body—and as the electrical

NOTE.

* Theſe experiments I never ſaw particularly made, but the concluſions neceſſarily follow from ſome which I have ſeen, as well as from thoſe pointed out above.

NOTE.

† Pure as to the purpoſes of electricity, or free from conducting vapours; perhaps pure elementary air is not to be found in our atmoſphere.

ſtates of theſe clouds may be very different from each other, from the different electrical ſtates of thoſe parts of the atmoſphere in which they gather—the general equilibrium of the atmoſphere over a country, cannot be reſtored by a ſingle diſcharge, but ſucceſſive flaſhes will dart from cloud to cloud, and between theſe and the earth, till at length the whole collected maſs of vapour is ſpent and diſſolved in rain.

Here a common obſervation naturally occurs, viz. that frequently, after a flaſh of lightning, a ſudden ſhower deſcends in large drops. The mutual attraction between the vapours and the air, when in this electrical ſtate, is ſufficient to ſuſtain the former, notwithſtanding that they are by this attraction greatly condenſed, being as it were forced into a phyſical contact, both with the particles of air, and with each other*.

But as ſoon as the air is reſtored to its natural electric ſtate by a flaſh of lightning, this attraction ceaſes, and the vapours precipitate by their own ſpecific gravity in a heavy ſhower.

Long and extenſive calms, in certain latitudes and ſeaſons, take place upon the ocean, during the continuance of which, the heat is ſcarcely tolerable†. Where theſe take place, the air will naturally undergo the ſame changes, in its denſity and electric capacity, as the air over the land does in the ſummer ſeaſon, and, when ſufficiently heated and rarefied, will, in like manner, aſcend, its place being ſupplied by the denſer air from all quarters without the limits of the calm. This heated and conſequently (granting the principles of the preſent theory) electrical air, when raiſed to a certain height in the atmoſphere, may become as well adapted to the formation of a thunder cloud, from the vapours which are perpetually exhaling from the ſea, as the air over the land under the like circumſtances. Wherefore, in ſome lati-

NOTE.

* A gentleman of my acquaintance, who is both intelligent and curious, informed me ſome years ſince, that he was once upon the top of a mountain in Spain, upon which a thunder cloud gathered; that as ſoon as the cloud became inſulated from the mountain, it diſcharged a violent tempeſt of thunder and lightning upon the plains below; that he never was ſo thoroughly ſoaked in the moſt violent ſhower, as when in the body of this cloud, though without a drop of rain, feeling as if he had been immerſed in a river. This idea is further juſtified by the ſolid appearance of the clouds, that riſe in the weſt, on a hot ſummer's day, compared with thoſe which float in the atmoſphere at other ſeaſons; which ſhews a manifeſt difference in their denſity and contexture. And when we obſerve attentively the ſeveral parts of a thunder cloud, the

NOTES.

diſtinctneſs of their borders and their ſwelling ſurbeloes—how ſtrongly they reflect the rays of the ſun, thereby exhibiting the moſt vivid lights and deep contraſting ſhades—and on the other hand obſerve the beautiful effects of their refractive power, in the intenſe golden ſkirts which adorn the riſing cloud, with a ſetting ſun behind it—we muſt neceſſarily conclude, that, although the vapours, of which ſuch clouds conſiſt, are collected and condenſed in higher regions of the atmoſphere, than are thoſe which uſually form clouds at other ſeaſons, yet their denſity and ſpecific gravity is much greater; and they derive their ſupport from the electric principle.

† See note, page 236.

tudes in all ſeaſons, and perhaps in all latitudes in different ſeaſons of the year, thunder ſtorms may as well happen at ſea, even at remote diſtances from land, as aſhore.

I now proceed to conſider an objection, which may be raiſed againſt the foregoing theory, which I ſhall firſt ſtate in its full force, and then endeavour to give a ſatisfactory anſwer to it.

Objection. If the electrification of that body of air, in which a thunder cloud is formed, depends upon the heat it has previouſly acquired, whence is it that thunder ſtorms are frequently attended with ſhowers of hail, which hail is ſometimes ſo large as to indicate its deſcent from the coldeſt regions of the atmoſphere?

Anſwer. Sir Iſaac Newton aſſerts, from experiments of his own, that "the denſity of the air in the atmoſphere of the earth is as the weight "of the whole incumbent air." Conſequently, the air gradually decreaſes in denſity from the ſurface of the earth to the top of the atmoſphere. The body of air which is ſuppoſed in this theory to be qualified by the action of heat upon it, to become a proper *ſubſtratum* for the formation and ſupport of a thunder cloud, is thereby expanded and rarefied, and thence becomes ſpecifically higher than it was before: it therefore aſcends till it arrives at that height in the atmoſphere, at which the air is naturally, from its ſituation, of the ſame rarety with itſelf; and there it reſts in equilibrio. This region is extremely cold at all ſeaſons, as appears from the teſtimonies of travellers who have viſited the tops of very high mountains, even under the line. The greater the heat, which this body of air requires below, the greater degree of rarefaction it undergoes, and the higher, of conſequence, it aſcends in the atmoſphere, where the cold is proportionably more ſevere, than is uſual near the ſurface of the earth. But though it was the heat which it acquired below, that firſt rarefied and expanded it, it will by no means be proportionably re-condenſed by the cold which it meets with in its aſcent; for as the heat, which occaſioned its rarefaction, decreaſes upon that account, the preſſure of the incumbent atmoſphere upon it, decreaſes as it riſes, whereby its denſity may, upon the whole, remain nearly the ſame; if ſo, may we not ſuppoſe its electrical ſtate alſo, previous to the formation of the cloud, to continue nearly the ſame? for ſhould this warm air aſcend all together as in a body, without intermixing with the denſer ſurrounding air through which it riſes, as a bubble of air does in any other fluid, and as this air probably would in a calm ſeaſon, the denſer parts of the atmoſphere eaſily giving way to it, till it arrives at that region, the denſity of which is equal to its own, where it would be at reſt; ſhould this, I ſay, be the caſe, it would not, even in that cold region, cool ſo ſuddenly as to undergo any immediate change in its electrical ſtate, from the natural coldneſs of the region; neither would it be from condenſation, its denſity remaining nearly the ſame, as obſerved above.

But when the cloud is formed, or rather when a number of clouds are forming in the neighbourhood of each other, and joining their forces preparatory to the tempeſt, a general confuſion takes place in the atmoſphere; various and even contrary currents of air flowing promiſcuouſly hither and thither, as is evident from the viſible irregular motions of detached parts of the clouds. In this general effort of nature, to reſtore an equilibrium, ſome of theſe aerial currents will probably introduce air, which having been till now

at a diſtance from the ſcene of action, has ſuffered no material change in its natural electric ſtate* ; and is, on the contrary, fraught with all the cold which is natural to the region of the atmoſphere from whence it came. In falling through this adventitious current of air, the drops of rain, precipitating from the body of clouds above, are congealed into ice, and deſcend in hail, which, as it falls, collects other ſnowy or icy particles round it ; a hail-ſtone, when it comes to the ground, reſembling denſe ſnow with a nucleus or kernel of ſolid ice in the middle.

That the air, which this hail-ſtone falls through, is colder than the region from whence it deſcends, may be thus proved, viz. If the freezing took place, where, and as ſoon as, the vapours were firſt ſet at liberty by a flaſh of lightning, it would be impoſſible for them ever to unite into drops, but they muſt deſcend in the fineſt cryſtals, an aſſemblage of which conſtitutes a flake of ſnow ; the nucleus, or proper hail-ſtone, muſt then have been firſt a fluid drop, and afterwards congealed in its fall through a colder region than that in which it was formed.

It may be further objected, that a thunder cloud, in the eaſtern parts of America, always makes its firſt appearance in the weſt, over the land, its progreſs being towards the ſea ; which ſeems to contradict the ſuppoſition in the theory, that the vapours, of which it conſiſts, are chiefly ſupplied from the ſea.

To which I anſwer, 1. That a thunder cloud is with us very rarely—indeed ſcarcely ever—formed in the weſt, without a ſea-breeze ſpringing up previouſly from the eaſt. 2. That the ſea air, as obſerved before, always abounds with vapours, although, from the cauſes already aſſigned, they are uſually, at their firſt riſing, inviſible. 3. That the firſt appearance of a cloud will always be where the vapours are firſt collected into a body and condenſed, and thereby rendered viſible, which, in a thunder cloud, will be in the weſt, notwithſtanding the vapours, of which it conſiſts, may chiefly have ariſen from the ſea. 4. That when a thunder cloud is once formed, it will be in a ſtate of attraction with the earth in general, and more eſpecially ſo with all ſubſtances which are natural conductors of the electric fluid, ſuch as the water contained in rivers, bays, arms of the ſea, &c. and by theſe the courſe of a thunder cloud is known to be very ſenſibly affected.

But the ocean is the grand object towards which its courſe will be directed ; accordingly, the progreſs of the clouds is from the weſtern horizon, eaſtward, be the weather below what it may, not excepting the moſt violent eaſterly ſtorms, which are ſometimes, though but rarely, accompanied with thunder and lightning.

To the foregoing obſervations I would add, 5. That when an extenſive thunder cloud is forming in the atmoſphere, by means of the mutual attraction of the condenſing vapours, and the body of electriſed air, which ſuſtains and condenſes them, the increaſing denſity of the whole compound maſs of air and vapour will, by degrees, occaſion its re-deſcent towards the earth, from the law of gravity : it will alſo be attracted by,

NOTE.

* This ſuppoſition will be juſtified by conſidering, that ſuch is frequently the ſtate of the atmoſphere, that the thunder clouds, which are formed in it, are but of ſmall extent : notwithſtanding which, the change in the ſtate of the air, occaſioned by them, is perceived to the diſtance of many leagues round.

and move towards the ocean, upon the principles of electricity; the cloud will then deſcend obliquely, in a diagonal between the directions of theſe two powers; and both, continually acting upon it, will jointly accelerate its motion. Such a cloud, if denſe and large, would end in a perfect tornado, either upon the land or water, as thunder ſhowers frequently do; ſmaller clouds being alſo uſually accompanied with guſts or flurries of wind.

I ſhall here add one obſervation more, which I have frequently made, and which may tend to confirm the foregoing theory, viz. That, as the general courſe of the eaſtern coaſt of North America, is from north-eaſt to ſouth weſt; the courſe of a thunder cloud is uſually from the north-weſt, with the wind at ſouth-eaſt, perpendicular to the direction of the coaſt, and contrary to each other.

Inland ſeas and great lakes, ſuch as are thoſe in North America, may anſwer the ſame purpoſes, in the interior parts of the country, as the ocean does near the limits of the continent, both by affording the neceſſary ſupplies of vapours for the formation of the clouds, and by their attractive influence upon thoſe clouds, when formed.

I now conclude with a few hints, which I ſhall throw into the form of queries.

1. Whatever the primary cauſe of evaporation may be, does not the formation of vapours into diſtinct clouds depend upon the electrical ſtate of the atmoſphere?

2. Were the atmoſphere always uniformly electrical, could we have any rain* ? in that caſe, if evaporation be performed independent of electricity, ſhould we not be enveloped in everlaſting fogs?

3. Mr. Canton ſuppoſes that "the "*aurora borealis* may be the flaſhing "of electric fire from poſitive towards "negative clouds, throughout the "upper part of the atmoſphere." But as the air is uſually charged more or leſs with vapours, even when perfectly peliucid—and as the moſt remarkable *aurorae* frequently appear without a cloud in the hemiſphere, may not this phenomenon be rather occaſioned by the "flaſhing of electric fire," from one region or body of air to another, in a different ſtate of electricity, through the intervening vapours?

4. May not the reaſon of its uſual appearance in the north, and of its flaſhing ſouthward, be, that, in every northern latitude, the air to the ſouthward is, at all ſeaſons of the year, *caeteris paribus*, more affected by the heat of the ſun than the air northward of the ſame latitude? and does not this occaſion an electrical current to flow from north to ſouth, as often as the above-mentioned circumſtances concur, though with ſome interruption from the irregular diſpoſition of the conducting vapours? and may not this occaſion thoſe gleams and ſtreams with which the phenomenon is uſually attended?

NOTE.

* Signor Beccaria concludes from experiments, that gentle rains are the effects of a moderate, as thunder ſhowers are of a more plentiful, electricity.

Addreſs to the minority of the convention of Pennſylvania.

(*Continued from page* 168.)

NUMBER II.

Gentlemen,

THE principal object of my laſt paper was to point out a variety of inſtances, in which the agency and powers of the ſtate governments are abſolutely neceſſary to the exiſtence of civil ſociety, and to the execution of the federal conſtitution itſelf. I there particularized certain

important matters neceſſary to be done from time to time, which cannot be attempted or performed by the general government. Here, then, we find, not only that the ſtate powers will not be annihilated, but that they are ſo requiſite to our ſyſtem, that they cannot be diſpenſed with.

Having ſeen what congreſs cannot do, let us now proceed to examine what the ſtate governments muſt or may do.

Firſt, then, each ſtate can appoint every officer of its own militia, and can train the ſame, by which it will be ſure of a powerful military ſupport, attached to, and even part of itſelf, wherein no citizen of any other ſtate can be a private centinel, much leſs have influence or command.

2dly. Every regulation relating to religion, or the property of religious bodies, muſt be made by the ſtate governments, ſince no powers, affecting thoſe points, are contained in the conſtitution.

3dly. The ſtate legiſlatures and conſtitutions muſt determine the qualifications of the electors for both branches of the federal government; and here let us remember to adhere firmly, within our reſpective commonwealths, to genuine republican principles. Wiſdom, on this point, which lies entirely in our hands, will pervade the whole ſyſtem, and will be a never-failing antidote to ariſtocracy, obligarchy, and monarchy.

4thly. Regulating the law of deſcents, and forbidding the entail of landed eſtates, are excluſively in the power of the ſtate legiſlatures. A perfect equality, at leaſt among the males, and poſſibly among the females, ſhould be eſtabliſhed, not only in the ſtrict line of deſcent, but in the moſt remote collateral branches. If a man omits to make a will, the public ſhould diſtribute his property equally among thoſe who have equal pretenſions, and who are able to render equal ſervices to the community. By theſe means, poverty and extreme riches would be avoided, and a republican ſpirit would be given to our laws, not only without a violation of private rights, but conſiſtently with the principles of juſtice and ſound policy. This power, with that mentioned under the laſt head, if exerciſed with wiſdom and virtue, will preſerve the freedom of the ſtates beyond any other means.

5thly. The elections of the preſident, vice-preſident, ſenators, and repreſentatives, are excluſively in the hands of the ſtates, even as to filling vacancies. The ſmalleſt interference of congreſs is not permitted, either in preſcribing the qualifications of electors, or in determining what perſons may or may not be elected. The clauſe, which enables the federal legiſlature to make regulations on this head, permits them only to ſay at what time in the two years, the houſe of repreſentatives ſhall be choſen; at what time in the ſix years, the ſenate ſhall be choſen; and at what time in the four years, the preſident ſhall be elected; but theſe elections, by other proviſions in the conſtitution, muſt take place every two, four and ſix years, as is declared in the ſeveral caſes reſpectively.

6thly. The ſtates will elect, appoint, and commiſſion all their own officers, without any poſſible interference of the federal government.

7thly. The ſtates can alter and amend their ſeveral conſtitutions, provided they do not make them ariſtocratical, oligarchic, or monarchical—for the federal conſtitution reſtrains them from any alterations that are not really republican. That is, the ſovereignty of the people is never to be diminiſhed or deſtroyed.

8thly. The ſtates have the power to erect corporations for literary, religious, commercial, or other pur-

poſes, which the federal government cannot prevent.

9thly. Every ſtate can always give its diſſent to federal bills, as each has a vote in the ſenate and houſe of repreſentatives, ſecured by the conſtitution. Hence it appears, that the ſtate governments are not only intended to remain in force within their reſpective juriſdictions, but they are always to be known to, and have their voices, as ſtates, in, the federal councils.

10thly. The ſtates are not only to elect all their own officers, but they have a check, by their delegates to the ſenate, on the appointment of all federal officers.

11thly, The ſtates are to hold ſeparate territorial rights, and the domeſtic juriſdiction thereof, excluſively of any interference of the federal government.

12thly. The ſtates will regulate and adminiſter the criminal law, independently of congreſs, ſo far as it regards *mala in ſe*, or real crimes; ſuch as murder, robbery, &c. They will alſo have a certain and large part of the juriſdiction, with reſpect to *mala prohibita*, or matters which are forbidden, from political conſiderations, though not in themſelves immoral; ſuch as unlicenſed public houſes, nuiſances, and many other things of the like nature.

13thly. The ſtates are to determine all the innumerable diſputes about property, lying within their reſpective territories, between their own citizens, ſuch as titles and boundaries of lands, debts by aſſumption, note, bond, or account, mercantile contracts, &c. none of which can ever be cognizable by any department of the federal government.

14thly. The ſeveral ſtates can create corporations, civil and religious; prohibit or impoſe duties on the importation of ſlaves into their own ports; eſtabliſh ſeminaries of learning; erect boroughs, cities, and counties; eſtabliſh and promote manufactures; open roads; clear rivers; cut canals; regulate deſcents and marriages; licenſe taverns; alter the criminal law; conſtitute new courts and offices; eſtabliſh ferries; erect public buildings; ſell, leaſe, and appropriate the proceeds and rents of their lands, and of every other ſpecies of ſtate property; eſtabliſh poor-houſes, hoſpitals, and houſes of employment; regulate the police, and many other things, of the utmoſt importance to the happineſs of their reſpective citizens. In ſhort, beſides the particulars enumerated, every thing of a domeſtic nature muſt or can be done by them.

In addition to this enumeration of the powers and duties of the ſtate governments, we ſhall find many other inſtances under the conſtitution, which require or imply the exiſtence or continuance of the ſovereignty and ſeveralty of the ſtates. The following are ſome of them:—

All proceſs againſt criminals, and many other law proceedings will be brought by, and run in the name of, that commonwealth, in which the offence or event ſhall have taken place.

The ſenate will be repreſentatives of the ſeveral ſtate ſovereignties.

Every ſtate muſt ſend its own citizens to the ſenate and to the houſe of repreſentatives. No man can go thither, but from the ſtate, of which he is a complete citizen, and to which, if they chooſe, he ſhall be ſworn to be faithful.

No ſtate ſhall, on any pretence, be without an equal voice in the ſenate, and a vote in the houſe of repreſentatives.

Any ſtate may repel invaſions, or commence a war under emergent circumſtances, without waiting for the conſent of congreſs.

The electors of the preſident and

vice-preſident muſt not nominate more than one perſon of the ſtate to which they reſpectively belong: ſo careful is the federal conſtitution to preſerve the rights of the ſtates.

In caſe of an equality of votes in the election of the preſident or vice-preſident, a caſting voice is given to the ſtates, from a due attention to their ſovereignty, in appointing the republic head of the federal government.

The preſident of the united ſtates may require written communications from the governors of the ſtates.

Proviſion is made for adjuſting differences between two ſtates—or the ſtate and the citizens of another.

New ſtates may be admitted into the union. As all the territory of each ſtate is already in the union, it is clear that any diſtrict is expected to be ſettled on different ground, when erected into a ſtate, from what it did when it compoſed a number of counties, or a part of an already exiſting member of the confederacy.

Two ſtates may not become one, without the conſent of congreſs; which proves clearly that the convention held the ſeverality of the ſtates neceſſary. This is directly oppoſite to your idea, that conſolidation was intended. Each ſtate and the federal judiciary are to give faith and credit to the records and proceedings of every other ſtate.

The ſtates have, in the federal conſtitution, a guarantee of ſeparate republican forms of government.

Two thirds of the ſtates in the propoſed confederacy can call a convention; not two thirds of the people.

Three fourths of thoſe ſtates can alter the conſtitution; not three fourths of the people.

From this examination of the propoſed conſtitution for the united ſtates, I truſt it will appear, that, though there are ſome parts of it, which, taken ſeparately, look a little like conſolidation, yet there are very many others, of a nature which proves, that no ſuch thing was intended, and that it cannot ever take place.

It is but ſince the middle of the preſent century, that the principles and practice of free governments have been well underſtood; political ſcience having been much ſlower in its progreſs than any other branch. Perhaps this has been cauſed by the greater degree of paſſion, to which, from its nature, this department of knowledge is ſubjected. The principles, on which free ſovereignties ought to confederate, is quite a new queſtion, and a new caſe. It is difficult, therefore, to take it up at once in the proper way. One circumſtance has exceedingly obſcured the ſubject, and hid the truth from the eyes of many of us. Moſt of the ſtates being in the poſſeſſion of free governments, ſome have looked for the ſame forms in a confederating inſtrument, which they have juſtly eſteemed in their ſeveral ſocial compacts. Recommending this diſtinction as neceſſary to be taken home to your minds, when you examine the great ſubject before you, I ſhall ceaſe for the preſent to treſpaſs on your time.

A Freeman.

A view of the principles, operation, and probable effects of the funding ſyſtem of Pennſylvania—together with ſome obſervations on the effects of a ſinking fund—tending to ſhew, that this ſtate, by a proper application of her preſent reſources, may redeem the whole capital of her funded debt in a few years.

"Public credit is public wealth."

(Continued from page 182.)

OUR means are not leſs, in proportion to our debt, than thoſe of Great Britain were at the time al-

luded to, and our advantages in the uſe of them may be, in many reſpects, greater; when our federal government ſhall be properly organized, which it is the wiſh and the hope of every patriot may ſpeedily happen, theſe means and theſe advantages may be put in proper operation by the united ſtates. In the mean time, a curſory review and examination of the principles, operation, and preſent ſituation of the funding ſyſtem eſtabliſhed in Pennſylvania, may convey information, not leſs pleaſing than uſeful, to many of the citizens, and may poſſibly ſuggeſt hints which may be improved to public advantage.

The citizens of Pennſylvania had become, during the war, larger creditors of the united ſtates, than the citizens of any other ſtate, eſpecially in that part of the public debt which was contracted by loans. The ceſſation of the payment of intereſt in bills of exchange, according to the original contract, on which a conſiderable part of theſe loans was made, was therefore more deeply affecting and alarming to them than to others. They addreſſed congreſs by remonſtrance and petition, ſtating in pathetic terms the wretchedneſs of the ſituation to which they were reduced, and imploring relief; but the paramount neceſſities, created by the preſſure of the war, occaſioned a temporary ſuſpenſion of the operations of juſtice to individuals, and left them without hope of ſpeedy relief from that quarter. They then applied to the legiſlature of the ſtate, ſuggeſting the reaſonableneſs and propriety of liquidating, on the whole, a burden which every one with eaſe could bear a proportionate part of, though oppreſſive to the individuals on whom it partially reſted. On this application, the legiſlature were pleaſed to make proviſion for the payment of one year's intereſt, as a temporary relief; and afterwards to make further proviſion for the payment of the intereſt annually, until congreſs ſhould be enabled to make permanent proviſion for diſcharging or funding the whole of the public debts contracted during the war.

By an act paſſed the 16th of March, 1785, the legiſlature, in order to make proviſion for the payment of this intereſt, as well as certain other payments therein mentioned, appropriated certain revenues to form a fund, viz.

I. The produce of the duties on goods imported from and after the 1ſt of November, 1784, eſtimated at the annual ſum of	£75,000	0	0
II. The produce of an annual tax, put in operation by virtue of this act, being the annual quota required of this ſtate, in aid of the duties on goods imported, for the purpoſe of paying the annual intereſt of the national debt, according to the recommendation of congreſs, of the 18th of April, 1783, and agreed to by the aſſembly of this ſtate, by their act of Sept. 23, 1783,	76,945	17	6
	£. 151,945	17	6

III. £. 100,000 of the bills of credit to be emitted.

IV. All the arrearages of taxes due on acts paſſed ſince the 1ſt of January, 1782; which arrearages were ſuppoſed to be about £. 400,000.

On this fund, the following annual payments were charged by the ſame act:

I. To the continental loan-officer, the eſtimated quota of this ſtate of the annual intereſt of the aggregate debt of the united ſtates; for the purpoſe of paying, firſt, the intereſt and arrears of intereſt on ſuch continental certificates as are therein deſcribed; and ſecondly, ſuch other intereſt as the united ſtates ſhould direct, - -	£.	123,932	0 0
II. The annual intereſt of the ſtate debt, which, it was ſuppoſed, would require, - -		15,000	0 0
III. To the late proprietaries annually for $7\frac{2}{3}$ years (one year's inſtalment having been otherwiſe provided for,)		25,000	0 0
IV. For ſinking the above-mentioned bills of credit, to commence in the year 1786, annually,		20,000	0 0
	£.	183,932	0 0

It was ſuppoſed that the bills of credit and the arrearages of taxes would enable the fund to ſupport theſe annual payments till the proprietary debt ſhould be diſcharged and the bills of credit redeemed, after which the fund would be diſburdened of 45,000l. per annum.

Theſe revenues were ſo calculated, in conformity with the ſyſtem recommended by congreſs, on the 18th of April 1783, as to enable the ſtate to be in conſtant readineſs to conform to that ſyſtem on her part, whenever it ſhould be acceded to by the other ſtates. And proviſion was made in the act, for conforming to the regulations of congreſs, whenever they ſhould be enabled to make adequate and permanent proviſion for paying or funding the whole debt.

Thus ſtood the ſtate-ſyſtem of funding, till the requiſition of congreſs, of September, 1785, made ſome alterations neceſſary, in order to avoid interfering with continental regulations.

By an act, paſſed in March, 1786, for complying with the requiſition of September 1785, ſo much of the funding act, as directed the payment of 123,932l. annually to the continental loan-officer, was repealed.

And by another act, paſſed in the ſame month, the holders of ſuch continental certificates, as were entitled to draw intereſt out of the ſtate fund, were authorized to deliver them to the comptroller general, as loans to the ſtate, and thereupon to receive ſtate certificates, of equal liquidated value, which would be entitled to draw intereſt half-yearly at the ſtate treaſury; by which means, the creditors would receive their intereſt with as much punctuality as before, and the ſtate negociate and pay its quota of the indents iſſued by the united ſtates, without putting them into circulation. Theſe alterations, however, brought an additional charge on the fund for that year, though they ſomewhat reduced the annual charge upon it afterwards: for, in order to comply with the requiſition of September, 1785, it was requiſite, beſides diſcounts for intereſt already paid by the ſtate, to advance 125,318 dollars to the united ſtates, in ſpecie, which ſum was charged upon and paid out of this fund.

This was the ſituation of the fund-

ing ſyſtem, after the alterations made by the act paſſed in March, 1786; and except the addition of ſome certificates, admitted by a later act into the new loan, which were not admiſſible under the original act, it has undergone no legiſlative alteration ſince. Let us now take a view of its operation and preſent condition. But in order to do this, it muſt be diſentangled from all other matters, and an account ſtated of the tranſactions under it, ſeparate and diſtinct from the other buſineſs of the treaſury. It is much to be regretted, that the accounts of the tranſactions under this ſyſtem, have not been kept, and annually ſtated to the public, in this manner; and it is to be hoped that in future they will be ſo ordered. In the mean time, the following eſtimates may ſerve to ſhew how the ſyſtem has operated hitherto, and afford a pretty juſt view of its preſent ſituation and circumſtances, though they may not be perfectly accurate. No notice is taken, in any of theſe eſtimates, of the ſupport of government, the redemption of depreciation certificates, former emiſſions of bills of credit, and ſome other ſtate engagements: becauſe other funds are appropriated to thoſe purpoſes, which either are or ought to be made adequate to them.

An account of the actual receipts and payments, under the funding ſyſtem of Pennſylvania, from March, 1785, to the firſt of November, 1787, as nearly as the ſame can be collected from the ſtatements of the comptroller general.

RECEIPTS.

Bills of credit put into the treaſury to be emitted as caſh,	£.	100,000	0 0
Impoſt duties for three years, from the 1ſt. of Nov. 1784 to the 1ſt of Nov. 1787, —ſay,		190,000	0 0
Taxes, and arrears of taxes, collected from March, 1785, to December, 1786,		148,500	0 0
Ditto, from thence to the 1ſt Nov. 1787,		124,667	0 0
	£	563,167	0 0

PAYMENTS.

One year's intereſt paid in 1785, through the hands of the continental loan-officer, 248,446. 84 dollars, equal to	£.	93,167	12 8
Paid to the united ſtates, to complete the ſpecie payment directed by the act of March 1786, 125,318 dollars,		46,995	5 0
Two years' intereſt paid by the ſtate-treaſurer on new loan certificates,		228,103	15 11
Four years' intereſt paid on the original ſtate debt,		40,469	5 3
Bills of credit cancelled,		40,000	0 0
	£.	448,735	18 3
Balance in ſtock,	£.	114,431	1 9

Whatever the true balance may be, it is not ſuppoſed that the whole is actually in the treaſury. Twenty or thirty thouſand pounds of the duties may be yet outſtanding; but whatever this amount may be, it will come in hereafter. The reſidue, however, (excepting ſuch farther payments as may have been ſince made, purſuant to the ſyſtem) is either in the treaſury, or has been bor-

rowed from this fund, and applied to other uſes. Whatever has been ſo borrowed, is to be replaced out of other funds.—128,489 dollars of this money appears, by the comptroller-general's ſtatement, to have been paid to the united ſtates, ſince completing the payment, directed by the above mentioned act, of March 1786, and therefore is not chargeable on this fund.

It will be obſerved, that, in the above account, no charge is made of any payment to the late proprietaries. They have received none out of this fund; the firſt inſtalment, which was otherwiſe provided for, being not yet all paid. The probable reaſon is, that they have declined taking farther payments on account of the preſent ſtate of the bills of credit; and they have a right to let their demand lie on intereſt, until they ſhall be offered payment in ſpecie. But it may alſo be obſerved, that the ſurplus of the fund is more than equal to the payment of the three inſtalments, which became due to the late proprietaries, at and before September, 1787, after doing more than the ordinary performance of its other functions; for, in leſs than two years and a half, from its eſtabliſhment, it hath paid three years' intereſt, on that part of the debt, called the new loan, and four years' intereſt on the original ſtate debt, beſides advancing the extra ſum charged upon it, for the united ſtates, and ſinking forty thouſand pounds of the bills of credit.

The following eſtimate will ſhew, that the annual produce of this fund is more than equal to the annual charges upon it.

Eſtimate of the receipts and payments under the funding ſyſtem for the enſuing year, that is, from the 1ſt of November 1787, to the 1ſt of November 1788.

RECEIPTS.

Balance brought forward from laſt year, - -	£.	114,431	1 9
Impoſt duties will probably produce -		60,000	0 0
Annual tax, - -		76,945	17 6
Arrears of taxes (there now remain £. 324,000 after a deduction of £. 30,000 for exonerations,) ſuppoſe a collection this year, of		50,000	0 0
	£.	301,376	19 3

The annual payments, directed by law, are:

One year's intereſt on the funded debt, including new loan and original ſtate certificates, - - -	£.	124,706	0 0
One year's inſtalment to the late proprietaries, - - - - -		25,000	0 0
For cancelling bills of credit, - - -		20,000	0 0
		169,706	0 0
Balance to be carried to next year,	£.	131,670	19 3

Which is £. 17,039 17 6 more than the balance brought forward from laſt year.

It is to be remembered, however, that three years' inſtalments, due to the late proprietaries, amounting to £. 75,000, beſides intereſt, remain chargeable on this balance.

Thus it appears, that the revenues appropriated to this fund, com-

puting £.50,000, a year, to be collected out of the arrears of taxes, amount to £. 186,945 17 6 per annum; and the annual payments, charged upon the fund, amount to £. 169, 706, which affords an annual ſurplus of upwards of £. 17,000, towards paying the arrearages of intereſt, or to be applied to the ſinking fund.

But that part of the revenue, which ariſes from the arrearages of taxes, muſt ceaſe in a few years, that is, when the £. 324,000, now remaining out, ſhall have been exhauſted. Before that happens, however, the fund will probably be relieved from the payment of £. 45,000 per annum, by the final diſcharge of the proprietary debt, and the extinction of the bills of credit. Or, if any part of theſe ſhould remain undiſcharged, the ſurplus or ſinking fund will be proportionably richer: becauſe the whole ſum, requiſite to complete theſe objects, is far ſhort of the amount of the taxes in arrear, after deducting £.30,000 for exonerations of ſome of the frontier inhabitants who were driven from their habitations by the ſavages. Let us then ſuppoſe the arrearages of taxes exhauſted, and the fund exonerated from theſe payments of £. 45,000 per annum. The eſtimate will then ſtand thus:

The current tax and duties produce per annum, - -	£.136,945 0 0
Annual intereſt of the funded debt, -	124,706 0 0
Annual ſurplus for the ſinking fund,	£. 12,239 0 0

It may be obſerved, that, in all the foregoing eſtimates, the annual intereſt has been computed on the whole amount of the certificates, iſſued and expected to be iſſued, chargeable on this fund, which remained unredeemed on the 1ſt of November laſt; and this is certainly the proper mode of eſtimating, in order to allow due operation and effect to a ſinking fund. But this capital is rated above the ſum that actually draws intereſt from the treaſury, even at the preſent time; for, of the original ſtate debt, included in the eſtimate, certificates to the amount of £.58,000, have not yet been iſſued, and a great part of them probably never will be. Of the certificates, which have been iſſued, there had been redeemed before the 1ſt. of November, 1787, to the amount of £.22,554, of the original ſtate debt, and £.37,705, of the new loan. And when we conſider the continual flow of theſe certificates into the land office, by new ſales of land, and the payment for old purchaſes and locations, we may fairly count upon a conſtant and conſiderable increaſe of the powers of the ſinking fund, eſpecially as the amount, yet remaining out, of the unfunded certificates receivable in the land office, is ſo ſmall, that thoſe which come in hereafter muſt be chiefly of the certificates charged upon the fund.

It may not be improper to remark, that an annual ſurplus of revenues, equal to one per centum, on any capital, funded at an intereſt of ſix per centum, would of itſelf be ſufficient to diſcharge the whole capital in a little more than thirty years. The ſurplus, already formed, if it were not for ſome arrears of intereſt yet due, would be little ſhort of this amount; and when we conſider the probable increaſe of it, by the means above mentioned, we may indulge a hope, that this funded debt, enormous as it may now appear, may be honourably diſcharged, by the means now in operation, in the courſe of twenty years, or perhaps in leſs time, if every advantage be fairly improved. This calculation of the power of a ſinking fund, i

made on a ſuppoſition, that the annual ſurplus of revenues, with its accumulating increaſe, is to be laid out in the purchaſe of capital, at full value. It is evident, that in this caſe ſuch purchaſes may be made, at leaſt for ſome time to come, on terms more advantageous to the public, and, of courſe, the debt may be reduced proportionably faſter. And however diſhonourable it may be to a ſtate or nation, to ſacrifice the property of its creditors, by neglecting to make proviſion for diſcharging its engagements, it can reflect no diſhonour on a ſtate, which fairly funds its debts, and punctually pays the intereſt, to purchaſe the principal at market price.

But, in order to effect this deſirable purpoſe, a ſtrict adherence to ſyſtem, and a ſacred regard to appropriations, are highly neceſſary, as well in the executive, as the legiſlative department. If the legiſlature would regularly and uniformly aſſign funds for every expenditure they authoriſe to be made, and oblige their officers ſo to form and keep their accounts, as to ſhew that every diſburſement was paid out of, and fairly charged upon the fund aſſigned for the purpoſe, it would not only produce regularity and order in the buſineſs of the treaſury, but tend much to promote economy in public affairs. They would better underſtand the ſtate of their affairs, and more readily perceive the probable effect of their own meaſures, and one aſſembly would be leſs likely to roll upon another the burden of providing for the payment of debts, which they have contracted. A legiſlature, which uniformly deviſes and eſtabliſhes the means of defraying every expenſe it authorizes to be incurred, may be ſaid to pay as it goes, and will never want credit on ſudden and extraordinary occaſions, which may require engagements to be made, before the means of payment are eſtabliſhed. But on all ſuch occaſions, it is neceſſary to the preſervation of public credit, to provide for the performance of paſt engagements, before new ones are contracted. And a legiſlative appropriation of a fund or branch of revenue, for the payment of a debt, or the performance of a contract, ought to be as ſacredly obſerved and adhered to, as the mortgage of an eſtate by an individual.

The writer of theſe obſervations hopes he ſhall be pardoned for this digreſſion. It is far from his intention to give offence, or to meddle improperly with the buſineſs of others; but he conceives it to be, in ſome meaſure, the duty as well as the right of every citizen of a commonwealth to contribute his mite to the general welfare; and he is not without hopes, that the obſervations now offered, may be improved to public advantage.

If this repreſentation of the principles, operation, and effects of the funding ſyſtem of Pennſylvania, be as juſt as the writer really believes it to be, it may tend to remove ſome prejudices againſt it, which want of information may have permitted to ariſe. There is an objection, however, which hath been raiſed againſt it, and which may require more particular notice: It has been ſaid, that the ſtate has aſſumed more than its proportion of the general debt of the united ſtates.

It will be remembered, that at the time this ſyſtem was formed, the aggregate debt of the united ſtates was eſtimated at ſomething more than forty-two millions of dollars;—that the quota of Pennſylvania, as it was computed at that time, and has been ever ſince, was little leſs than one ſeventh part, and amounted, by that rule of computation, to ſomething more than 5,745,000 dollars. The new loan (including 80,000 dol-

lars which may yet come in) amounted, on the 1ſt November 1787, to 5,148,994 dollars; part of which having been redeemed, the balance then remaining, on which the ſtate pays intereſt, was 4,997,779 dollars and 58 ninetieths;—a ſum conſiderably below the eſtimated quota of this ſtate, of the whole debt, and but very little more, than ſuch quota of the domeſtic part of it, according to the eſtimate, publiſhed by congreſs in 1783. That it has in any degree exceeded our proportion of the domeſtic part of the debt, has been owing to the citizens of Pennſylvania being original creditors in a greater proportion than others; for none, but certificates originally iſſued to citizens of Pennſylvania, or paid to them from the public, for ſupplies, were authoriſed to be admitted into the loan; and if by poſſibility a few have unavoidably crept in, which were not fairly entitled, they have probably been but very few, and can bear but a ſmall proportion to thoſe which were excluded, by having been alienated from the original holders, before the act took place. In a buſineſs of ſo great magnitude, and involved in circumſtances not eaſy to be inveſtigated, it was hardly to be expected, that general rules could be formed, leſs liable to exceptions, than thoſe by which the admiſſions to this loan have been governed. If the ſtate had, by theſe rules, aſſumed ſomething more than her proportion of the whole, it would have been but an equitable liquidation of a burden, which ought to be borne by the ſtate, rather than by individuals of her citizens. And if the ſtate may ultimately derive benefit, as well as honour, from the meaſures by which ſhe has obtained theſe, and other continental certificates, by being enabled to perform her federal duties with the more eaſe and facility, theſe meaſures may be conſidered as acts of good policy, as well as of juſtice. In order to ſhew, that this may probably be the caſe, it may be proper to take a view of the ſituation in which the ſtate will be placed, when the impoſt revenues ſhall be transferred to the united ſtates.

Great expectations are formed of the order, regularity, and punctuality, which will take place on the adoption of the new plan of government. Let us ſuppoſe theſe pleaſing expectations realized. The ſtate will then relinquiſh her ſeparate claim to the impoſt duties, now eſtimated at £.60,000 per annum, but ſhe may keep poſſeſſion of all her other branches of revenue, if ſhe can meet and diſcharge at the threſhold her quota of the demands of the united ſtates. The impoſt ſyſtem will probably yield to the federal treaſury, revenues ſufficient to fund the foreign debt, ſupport the civil government, and other eſtabliſhments, and do ſomething conſiderable towards paying the intereſt of the domeſtic debt. Our quota of what may be farther requiſite, may be ſomewhere between one and two hundred thouſand dollars. Beſides the certificates obtained by the new loan, the ſtate has acquired by other means, certificates to the amount of near one million of dollars; ſo that ſhe is poſſeſſed of continental certificates which entitle her to demand intereſt from the united ſtates to the amount of 371,782 dollars per annum.—The greater part of theſe belong to the funding ſyſtem: whether the reſt be added to it or not, the ſtate may join them in her claims upon the union; and the following eſtimate may ſhew the benefit to be derived from having this in her power, and that the funding ſyſtem may continue uninjured.

Annual intereſt due from the united ſtates 371,782 dol-

ars, equal to	£.	139,418	5 0
Annual tax, - -		76,945	17 6
Arrearages of tax- £. 324,000. Let us ppose they produce nually, till the pro- rietary debt shall be discharged, and the ills of credit re- deemed, - -		45,000	0 0
	£.	261,364	2 6
Charged thereon.			
Annual interest of e funded debt, -		124,706	0 0
Annual payment the late proprie- ors,		25,000	0 0
Annual redempti- n of bills of credit,		20,000	0 0
Annual reserve for sinking fund, -		20,000	0 0
	£.	189,706	0 0
Surplus, out of hich the requisi- ons of the united tes for the pay- ent of interest, may discharged, -	£.	71,658	2 6

Thus it appears, that the state of nsylvania hath obtained a situa- n, in matters of finance, more eli- ble, circumstances considered, than uld reasonably have been expected, d probably much better than many r citizens at this moment appre- nd. Her disbursements, under the nding system, do not impoverish, rather enrich the state. They distributed among her own citi- s, and, by enlivening the circula- n of money, they promote indus- y, and facilitate the collection of es and duties. The internal tax, ich scarcely exceeds eight shillings ery hundred pounds, on a mode- e valuation of estates, is light, when mpared with the object. What e will murmur at the payment of such a tax, when he considers that it is to support a system, which bids fair, in a few years, to revive and es- tablish the public credit of the state, discharge her proportion of the pub- lic debt, and do justice to her virtuous citizens, whose zeal in the common cause of their country, induced them to advance their property for the pub- lic service, in times of difficulty and distress—in times when many who are now at ease, would have thought it a happy compromise, if they could have purchased, with a moiety of their property, the peace, liberty, and safety which now court their culture and enjoyment?

Let us attend to the language of congress, in their address to the sever- al states accompanying the recom- mendation of the 18th of April 1783, whereby they demanded this tax for twenty-five years, to the precise a- mount, and for the very purpose, to which it is now appropriated, with this circumstantial difference only, in the mode of application, that what is raised in the state, is now paid to her own citizens; whereas if it had gone first into the general treasury, a small proportion only might have come back to our citizens; the rest would probably have been thought necessary to supply the deficiencies of other states.

"The plan, thus communicated "and explained by congress, must "now receive its fate from their "constituents. All the objects com- "prised in it, are conceived to be of "great importance to the happiness "of this confederated republic; are "necessary to render the fruits of the "revolution a full reward for the "blood, the toils, the cares, and the "calamities which have purchased "it. But the object, of which the "necessity will be peculiarly felt, and "which it is peculiarly the duty of "congress to inculcate, is the provi- "sion recommended for the national

" debt. Although this debt is greater
" than could have been wiſhed, it is
" ſtill leſs, on the whole, than could
" have been expected; and when re-
" ferred to the cauſe in which it has
" been incurred, and compared with
" the burden, which wars of ambition
" and of vain glory have entailed on
" other nations, ought to be borne,
" not only with cheerfulneſs, but with
" pride. But the magnitude of the
" debt makes no part of the queſtion.
" It is ſufficient, that the debt has
" been fairly contracted, and that
" juſtice and good faith demand that
" it ſhould be fully diſcharged. Con-
" greſs had no option, but between
" different modes of diſcharging it.
" The ſame option is the only one
" that can exiſt with the ſtates. The
" mode which has, after long and
" elaborate diſcuſſion, been preferred,
" is, we are perſuaded, the leaſt ob-
" jectionable of any that could have
" been equal to the purpoſe. Under
" this perſuaſion, we call upon the
" juſtice and plighted faith of the
" ſeveral ſtates, to give it its proper
" effect, to reflect on the conſequences
" of rejecting it, and to remember
" that congreſs will not be anſwera-
" ble for them.

" If other motives, than that of
" juſtice, could be requiſite on this
" occaſion, no nation could ever feel
" ſtronger: for to whom are the
" debts to be paid?

" To an ally in the firſt place,
" who to the exertion of his arms in
" ſupport of our cauſe, has added
" the ſuccours of his treaſure; who,
" to his important loans, has added
" liberal donations; and whoſe loans
" themſelves carry the impreſſions of
" his magnanimity and friendſhip.

" To individuals in a foreign
" country, in the next place, who
" were the firſt to give ſo precious a
" token of their confidence in our
" juſtice, and of their friendſhip for
" our cauſe, and who are member
" of a republic which was ſecond i
" eſpouſing our rank among nation

" Another claſs of creditors is th
" diſtinguiſhed and patriotic h
" of fellow citizens, whoſe blo
" and whoſe bravery have defend
" the liberties of their country; w
" have patiently borne, among oth
" diſtreſſes, the privation of the
" ſtipends, while the diſtreſſes
" their country diſabled it from b
" ſtowing them; and who, eve
" now, aſk for no more than ſuch
" portion of their dues as will ena
" ble them to retire from the field o
" victory and glory into the boſom
" of peace and private citizenſhip
" and for ſuch effectual ſecurity fo
" the reſidue of their claims as thei
" country is now unqueſtionably a
" ble to provide.

" The remaining claſs of credi
" tors is compoſed partly of ſuch o
" our fellow citizens as originall
" lent to the public the uſe of thei
" funds, or have ſince manifeſte
" moſt confidence in their countr
" by receiving transfers from the le
" ders, and partly of thoſe wh
" property has been either advanc
" or aſſumed for the public ſervi
" To diſcriminate the merits of the
" ſeveral deſcriptions of creditor
" would be a taſk equally unneceſ
" ry and invidious. If the voice
" humanity plead more loudly in f
" vour of ſome than of others, t
" voice of policy, no leſs than
" juſtice, pleads in favour of a
" A wiſe nation will never perm
" thoſe who relieve the wants
" their country, or who rely moſt o
" its faith, its firmneſs and reſource
" when either of them is diſtruſte
" to ſuffer by the event."

THE writer of the foregoin
pamphlet has found, on farth
inveſtigation, that ſome erro
were committed in ſtating the a

count of actual receipts and payments under the funding ſyſtem from March 1785, to the firſt of November 1787, owing chiefly to the imperfect ſtate of the documents from which he drew his information at the time of writing. As truth was the object of his enquiry, and fair and candid information to his fellow citizens, his intention in publiſhing the reſult, ſimilar motives induce him now to offer the following corrections and obſervations.

The produce of the duties on goods imported from the 1ſt of November 1784, to the 1ſt of November 1787, was eſtimated in the account alluded to, at £.190,000. This eſtimate was formed on the beſt information he could obtain at the time, and was intended to be ſtated rather below than above the true ſum. But the accounts relative to theſe duties, had not then been ſo ſtated as to ſhew the net produce of the duties appropriated to this ſyſtem, after deducting drawbacks, office expenſes, and ſuch duties as have been created by ſubſequent acts of the legiſlature, and which yet remain unappropriated. This laſt article, amounting to near £.40,000, occaſions a much larger deduction than was apprehended, and of courſe leaves leſs of the aggregate amount for the funding ſyſtem than was ſuppoſed. But on the other hand, it appears by a report of the comptroller general, lately exhibited to the committee of ways and means, that the other revenues appropriated to the ſyſtem, have produced more money to the treaſury within the time mentioned, and that the payments chargeable thereon, have been leſs than are ſtated in the ſaid account. So that on the whole, the balance in favour of the ſyſtem on the 1ſt of November 1787, as a proviſion towards making the payments charged upon it, will not be leſs than the balance ſtated in the ſaid pamphlet, [ſee page 148] notwithſtanding this great deficiency in the amount of the appropriated duties. In another reſpect, however, this deficiency will have an injurious, though not a fatal effect on the operations of the ſyſtem. The annual produce of the appropriated duties for the current and future years has been eſtimated at £. 60 000. The year 1786 produced leſs than £. 40,000. The year 1787 ſomething more than £. 42,000. So that although it is again riſing, it may fall fifteen or £. 20,000 ſhort of the eſtimate. In ſuch caſe the arrearages of intereſt due to the public creditors, may not be ſo ſpeedily paid, nor the ſinking fund ſo briſkly operative as might be expected, if this ſource of revenue were more productive. But if the taxes are collected with decent punctuality, or even as well as they have been collected hitherto, the appropriated revenues may ſtill keep pace with the current payments charged upon them; and the reduction of the capital of the debt by receipts in the land-office, will ſoon create a ſinking fund, that, if faithfully managed, may diſcharge the whole debt in twenty years, or probably in leſs time.

In the comptroller general's late report, in which he ſtates, but £.109,726 17 10 to have been actually received for duties appropriated to the funding ſyſtem within the three years from the 1ſt of November 1784, to the 1ſt of November 1787, he ſhews that the receipts on account of that ſyſtem have nevertheleſs exceeded the payments £. 61,162 2 9. Of the appropriated duties which aroſe within that time, about £. 25,000 had not been actually received on the 1ſt of November, and are therefore left out of the comptroller general's account; but as they aroſe within the time, and have been ſince received, or ſhortly

will be, they ought to be added to the eſtimate. There is alſo charged to the account of this ſyſtem 86,658 dollars, of the payments made to the united ſtates, beyond what the legiſlature have directed to be charged. If theſe two ſums be added to the balance ſtated by the comptroller general in favour of the ſyſtem on the 1ſt of November laſt, it will ſhew that this fund had a balance in ſtock on that day, of about £.118,000, all of which had been actually received in the treaſury, except the £.25,000 then due for duties, the greater part of which has been ſince received. Out of this balance, however, three inſtalments due to the late proprietaries, amounting to £.75,000, together with ſome intereſt, remain to be paid.

Speech of an Indian.

UPON the return of Cornplanter, an Indian chief, to his nation, in the year 1786, he praiſed the bleſſings of civil government, and propoſed to his countrymen to exchange their ſavage mode of life, for the pleaſures of civil ſociety, and offered a plan of government for that purpoſe. Whereupon Caiaſhuta, another chief, aroſe, and addreſſed his countrymen in the following ſpeech, which may be conſidered as an anſwer to all that has been, or ſhall be written againſt the propoſed conſtitution of the united ſtates.

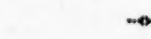
Brothers,

Before it is forbidden by law to ſpeak every thing we think, and do what we pleaſe, I ſhall take the liberty of bearing a teſtimony againſt the government that has been propoſed to us.

I ſhall begin by informing you, that it will deprive us of many of our deareſt natural rights. It will prevent our fiſhing or hunting upon the grounds of our neighbours. It will take away from us the power of revenge (ſo ſweet to an Indian) and transfer it to certain perſons called judges and magiſtrates. It will prevent our taking as many wives as we chooſe, and changing them as often as we pleaſe. It will compel us to hoe our own corn, and cook our own victuals, both of which are employments ſuited only for women. It will reſtrain us from drinking and ſmoaking, by impoſing heavy duties upon rum and tobacco, and thereby deprive us of two of the higheſt pleaſures of life. It will puniſh certain acts which we deem eſſential to liberty, and a material portion of our deareſt rights, with impriſonment, whipping, and death. Our young men ſhall no more train themſelves for the delightful purſuits of war, by occaſional irruptions upon the American huſbandmen. A formal declaration of war, agreeable to the cuſtoms of civilized nations, will be neceſſary to ſanctify every murder, if we ſubmit to the reſtraints that will be impoſed upon us by civil government. No more will dexterity or ſecreſy in ſtealing, entitle our warriors to praiſe in peace, or pre-eminence in war. The pride of our nation, like the oak that yields to the north wind, will then mingle with the dead and noiſy leaves under our feet. Thoſe hands which never felt a ligature of any kind, ſhall then be bound in chains. Your backs ſhall ſwell with ſtripes, inflicted by the hands of mercileſs executioners: and even Caiaſhuta himſelf, who now addreſſes you, and who has ſo often led you to glory in war, and afterwards placed you in ſafety under the tree of peace, ſhall perhaps be the firſt victim to a law that ſhall place him upon a level with a dog, by depriving him of life, not by fire, not by a bullet, not by an arrow,

but by the ignominious puniſhment of the halter and the gallows. Theſe hoary locks will then kiſs, for the laſt time, the paſſing breeze. Caiaſhuta's wives ſhall then in vain weep at the feet of his angry judges, in hopes of obtaining his pardon: and his ſons ſhall be threatened with his fate, for nobly ſwearing they will revenge this death. And for what ſhall this neck be made like the crane's? For what ſhall his body feed the birds of the air? Why only for taking a horſe out of a neighbour's field, to ride on to our town, or for committing what the white men call treaſon, that is oppoſing the execution of a law of the ſtate, which was contrary to his intereſt or inclinations.

Nor, brothers, is this all. We muſt ſubmit to yield a certain portion of the profits of our labour for the ſupport of this government. The money, exacted from us for this purpoſe, will be called taxes. If we refuſe to pay them, our horſes, or cattle, or farming utenſils, will be ſeized by an officer, appointed for that purpoſe, and ſold for the amount of them. If they bring more than is due from us, the reſidue will be kept by the officer, who ſells them. The number and ſalaries of the officers of government will be beyond calculation. Nineteen men will be taken from their ploughs, and employed every day in the year, in an executive council, in reading news-papers, and giving away profitable offices. Even the ſecretary of this body, whoſe only buſineſs will be to light the fire of the counſellors, ſhall receive, for this ſervice, 750l. a year. Thus you ſee, brothers, the dangers and oppreſſions to which you will expoſe yourſelves, by adopting the moſt ſimple form of civil government, that can be offered to you. It will deſtroy our heaven-born equality of rank and property. It will furniſh the means of advancement to men who are noted for "wiſdom and virtue," and thereby favour their becoming the lords and maſters of their leſs wiſe and induſtrious neighbours. Brothers, our ſituation is not ſo bad as has been repreſented to you, by ſome ſpecious and declamatory orators, in their ſpeeches at a late council fire. Our cabins are ſtill proof againſt the ſnow ſtorm. Our granaries are ſtill filled with corn; and if we have not veniſon enough for all the families of our nation, the kettles of your head men have never been empty. The ſun ſhines bright through yonder cloud. The great ſpirit is propitious. We embrace once more the liberty, the independence, and the bleſſings of the ſavage life. Away with all your forms of civil government. They have all of them, in their turns, enſlaved the nations, that have adopted them. Even the ſimpleſt democracies have been the richeſt ſavannas of ſlavery. Savages alone have preſerved their liberties. Who ever heard of an Indian tyrant or ſlave? ſhew me the one, or the other, and this tomahawk ſhall immediately ſlake its thirſt in his blood.



Extract from a memoir of the abbé de Commerel, on the culture, uſe, and advantages of the ſcarcity root.

THE ſcarcity root is but lately introduced into France. In Germany, where they are much in the uſe of it, they give it the name of dick ruben, great rape, and, in ſome places, dick wurzel, the great root, and mangel wurzel, ſcarcity root; becauſe it thrives, and furniſhes an excellent food for man and beaſt, when other nutriment is ſcarce and dear. This root cannot be claſſed either with the turnip or carrot; and though, both in appearance and

by its ſeed, it reſembles the beet, yet it greatly excels that root, and ſeems to form a ſpecies of itſelf. Its culture is ſo eaſy, its uſes ſo many, and it ſupplies ſo well the place of other forage, that it deſerves particular attention, and claims the preference to all other roots, uſed for the food of cattle. It ſucceeds in all ſorts of ground, but beſt in moiſt light land.

This precious root is not affected by the viciſſitudes of the ſeaſons, nor has it any deſtructive enemy. The vine-fretter which ravages every other plant, does not touch it. It is not ſubject to mildew, nor does the greateſt drought ſtop its vegetation. It does not impoveriſh the ſoil, where it grows, but rather improves and renders it fit for wheat, or any other grain, one chooſes to ſow in it, before winter.

In order to promote the culture of this precious root and inſure ſucceſs, I will point out the time and manner of ſowing the ſeed; of tranſplanting and cultivating the plants; and of gathering the leaves, which are produced in conſtant ſucceſſion, and in great abundance, and are excellent food for cattle. I will then give directions for gathering, curing, and preſerving the roots, and point out the time for replanting them, in order to procure ſeed. I will alſo point out the manner of preparing the roots, for feeding and fattening large cattle, and raiſing calves; and then ſay ſomething of the general advantages to be derived from it.

I. *The time and manner of ſowing the ſeed of the ſcarcity root.*

The ſeed may be ſown at any time, from the laſt of February to the middle of April, when the ſeaſon will permit the ground to be prepared. It may be ſown either broad-caſt, or in rows at five inches apart; and ſhould be covered, at leaſt an inch deep, with good earth. It ſhould be ſown thin, becauſe it is large, and becauſe thereby it is eaſier weeded; and becauſe by that means the plant becomes thrifty and vigorous. The ſeed is commonly ſown in a garden, or in a piece of good land, well prepared for the purpoſe.

II. *The preparation of the ground, for tranſplanting the roots.*

As ſoon as the ſeed is ſown, it becomes neceſſary to prepare a piece of ground, where the roots may be tranſplanted. It is with theſe roots as with all other plants. The more the ground is dunged, and the better it is prepared, the finer and larger will the roots grow, and the increaſe of the leaves will be more abundant. In an indifferent ſoil, the roots will not weigh more than four or five pounds, and the leaves cannot be gathered more than four or five times. But in a good ſoil, they will weigh nine or ten pounds, and the leaves may be gathered eight or nine times. In light, ſandy, rich ſoil, they grow very large; and ſome of them will weigh from fourteen to ſixteen pounds.*

NOTE.

* Although the time for ſowing the ſeed is from the latter end of February to the middle of April, yet it may be well to ſow ſome ſeed every month, even to June; ſo as to have always plants fit to be tranſplanted to any vacant places either in the garden or in the fields. "In 1784, the flies" ſays the abbé, "having four times ſucceſſively deſtroyed the turnips I had ſown, I ſubſtituted in their place the ſcarcity roots. This was in the month of Auguſt. Nevertheleſs, I gathered the leaves three times; and the roots weighed from three to four pounds. On hemp and flax ground, after the hemp and flax is pulled, ſcarcity roots may be planted, and they ſucceed very well. And this ſecond crop, though of a different nature, will be worth as much as the firſt.

III. *The time and manner of tranſplanting the ſcarcity root.*

About the beginning of May, the ground being well turned up, either with the ſpade or with deep ploughing, and being well dreſſed and levelled, either with a rake or a harrow, it will then be time to examine this nurſery. If the roots be from five to ſix inches long, and about the thickneſs of a gooſe quill, they ſhould be pulled up. None of the fibres ſhould be trimmed off, but the top of the leaves may be cut, as is commonly done with endive. Then, with a dibble, holes are made in the ground, from four and a half, to five inches deep. The holes ſhould be in ſtrait lines, croſſing each other, at right angles, in the form of checkers, at eighteen inches diſtance, one from another. In each of theſe holes, a root is planted, ſo as to leave about half an inch of the root above the ground. This is a very eaſy, but a very eſſential precaution, without which the root will not thrive. In twenty-four hours, the plants take root. Any perſon, with a little practice, may readily plant from eighteen hundred, to two thouſand in a day.

IV. *The firſt gathering of the leaves, and culture of the roots.*

About the end of June, or the beginning of July, when the outer leaves are about a foot long, they are firſt gathered, breaking them off all round, cloſe to the root; for this purpoſe, the thumb is puſhed down on the inſide, to the root of the leaf. Care muſt be taken, not to leave any ſtumps of the leaves, nor ſhould any leaves be gathered, but ſuch as are bent towards the earth, the heart leaves being always preſerved with great care. Freſh leaves will immediately ſprout, and grow more vigorouſly. As ſoon as this crop of leaves is gathered, the ground ſhould be hoed, and the ſurface of the ground newly ſtirred, drawn from the roots, ſo that every root may be one inch and an half, or two inches out of ground; ſo that they will appear, as if planted in a baſin, of eighteen inches diameter. In light grounds, it will be ſufficient to cut down the weeds, and draw up the earth from the roots. After this operation, which is eſſentially neceſſary, nothing more is requiſite, but to gather in the leaves and the roots. This is the time, when the roots begin to extend and grow, in an aſtoniſhing manner.

V. *The product of the leaves,*

In good land, the leaves may be gathered every twelve or fifteen days. The abbé ſays, he has more than once found, that in twenty-four hours the leaves grew from twenty to thirty lines, that is, from two, to two and a half inches long, and eighteen lines, or one inch and a half broad; ſo that, at the ſecond gathering, they were from twenty eight to thirty inches long, and from twenty to twenty-two inches broad. This, he obſerves, will appear incredible, until experience demonſtrates the truth of it.

VI. *Their uſe for cattle.*

Oxen, cows, and ſheep, eat them greedily, thrive exceedingly, and ſoon fatten on them. They are given to them whole, as they come from the field. Dunghill fowls eat them, when cut into ſmall pieces, and mixed with bran. Even horſes can ſoon be brought to eat them, and may be kept upon them the whole ſummer. But then it will be neceſſary to chop them in pieces, with the inſtrument hereafter mentioned, for chopping the roots, and to mix them with chaff or cut ſtraw. Hogs eat them alſo, greedily.

It is to be obſerved, that milch-cows, which one would wiſh to keep ſo, may, without inconvenience, be fed entirely with theſe leaves, from eight to fifteen days ſucceſſively. Du-

ring the firſt days, the quantity of milk is encreaſed, and the cream is excellent: but if they be kept entirely upon this forage, they ſoon fatten aſtoniſhingly, and their milk gradually decreaſes. In order, therefore, to keep the cows to their milk, it will be neceſſary to mix graſs with the leaves, in the proportion of one part of graſs to two or three of leaves: or they may be fed with graſs once a day, or, every three days, fed one whole day on graſs. By this mean, the cows will be kept in fine order, and their milk will be excellent. When there is any appearance of rain, or bad weather, a ſufficient quantity of leaves ſhould be gathered, to laſt two or three days; but the heaps ſhould be frequently turned, to prevent their heating. In planting a quantity of roots, proportioned to the number of cattle to be fed or fattened, one is ſure of being ſupplied with a ſufficient quantity of leaves, be the weather what it may, even though there ſhould be a ſevere and long drought. The abbé obſerves, that he attempted to dry the leaves, and to uſe them for dry fodder, but did not find it anſwer.

VII. *The uſe of the leaves for men.*

The leaves furniſh a wholeſome and an agreeable nutriment for men; they are eaten like beets, but they have not the earthy taſte of the beet, but rather that of the artichoke. They may be dreſſed different ways. When dreſſed like ſpinage, many give them the preference. The roots may be boiled and eaten in the winter. The leaves, produced by the roots in a cellar, furniſh alſo a delicate ſallad in the winter.

VIII. *The gathering of the root.*

The firſt coming of hard froſt determines the moment for gathering in the roots. Fine weather ſhould be improved for this precious harveſt, even at the riſque of beginning ſome days ſooner, than might otherwiſe be neceſſary. It is of importance to the preſervation of the root, that it be ſtored without moiſture. The day being fixed on, the roots ſhould be pulled in the morning, and left on the ground, that the ſun and air may dry them. Children follow the pullers, and cut off the leaves cloſe to the root. This may be done while they are in the ground, the evening or ſome days before the pulling. In the evening, the roots are gathered into heaps. If they are well aired, they are then put under cover in a cellar, or other dry place, out of the reach of the froſt. If there be no danger of rain, they may be left on the ground all night, and carried next day to the magazine or place of depoſit. When the weather will admit of their being left in the air two or three days, it is of great advantage in preſerving them. They ſhould be handled gently in loading and unloading them; for as they have a very thin ſkin, they are eaſily bruiſed, and then they do not keep ſo well.

IX. *The choice of roots to be reſerved for ſeed.*

The time of gathering is the time for ſelecting roots proper for ſeed. The only roots proper for this, are thoſe of a middling ſize, even, ſmooth, the outſide of a roſe colour, and inſide white or marbled with red and white. Theſe are the marks to designate thoſe which ought to be ſet apart for this purpoſe. Thoſe which are all white or all red, are either degenerated or real beets, the ſeed of which has got mixed with that of the ſcarcity. The roots, deſigned for ſeed, muſt be kept by themſelves in a dry place entirely out of the reach of moiſture, or froſt.

X. *The time and manner of replanting the roots to bear ſeed.*

In the beginning of April, the roots, deſigned for ſeed, ſhould be planted deep in the ground, as the

diſtance of three feet one from the other. As their tops ſhoot up to the height of five or ſix feet, it is neceſſary to give them ſupporters. There ſhould be poles ſtuck in the ground a foot and a half deep, and ſtanding about ſeven feet above ground. They ſhould be interlaced with rods or boughs to form a kind of eſpalier; and to this eſpalier, the tops ſhould be faſtened, as they grow, that the wind may not break them.

XI. *The gathering of the ſeed, and manner of preſerving it.*

The ſeed commonly ripens about the end of October. It ſhould be gathered immediately, at the coming of the firſt white froſt. The tops are then to be cut off, and, if the weather will permit, may be hung up to dry, againſt a wall or fence. If the weather is bad, they ſhould be tied in handfuls, and hung up under cover, in any airy place, until they be quite dry. The ſeed is then beat off, and put into bags, and ſo kept, like other garden ſeeds.

Every root will produce from ten to twelve ounces of ſeed.

XII. *The way to prevent the roots from degenerating.*

The ſeed of the ſcarcity root degenerates, like all other ſeeds, unleſs care is taken, to change the ground every year, or, at leaſt, every two years; that is to ſay, by ſowing on ſtrong land, what was raiſed on light ſandy land; and on a light ſoil, what was raiſed on heavy ſtrong ground. So that farmers, who occupy different ſorts of ſoil, may mutually oblige each other, by exchanging their ſeed. The ſeed will keep good for three or four years.

XIII. *How to preſerve the roots, from November to the end of June.*

If the crop be large, and cannot all be houſed, then, ſome days before gathering, trenches ſhould be made in the ſame field, or in ſome other place, not liable to be covered with water in the winter. After leaving the trenches open eight or ten days, to dry, cover the bottom and ſides with ſtraw, and upon that, lay the roots, handling them gently, and taking care that they be well cleared of earth. Then cover them with ſtraw, and upon that, lay the earth, taken out of the trench, three feet thick, beating down the earth, and forming it into a heap, higheſt in the middle, that the water may eaſily run off.

XIV. *The dimenſions of the trenches.*

The dimenſions of the trenches ſhould be proportioned to the elevation or declivity of the ground. They may be from two to four feet deep. Their length will depend on the quantity of roots to be buried. Their width is commonly 3½ feet. As theſe roots will keep without ſpoiling, to the end of June, it will be well to make a number of trenches, viz. one for the conſumption of every month, beginning with March, the time when the winter proviſion, kept in the cellar, is commonly out. The reaſon for making ſeveral trenches is, becauſe the roots, if expoſed to the air, after they have been for a long time kept from it, are apt to ſpoil. This inconvenience may be prevented by multiplying the number of trenches.

XV. *The neceſſity and manner of making air holes.*

Every trench ſhould have an air-hole, by which the fermentation from the roots may exhale. Without this precaution, the roots, kept under ground, will ſpoil and rot. The manner of making air-holes is this; before any thing is put into the trench, fix, in the middle of it, a pole ſix or ſeven feet long, and two inches diameter, or between ſix and ſeven inches round; then lay your roots in the trench, forming them into a ridge, higheſt about the pole. When the trench is full, and the roots raiſed in the middle, half a foot above the

level of the earth, then twiſt a hay rope, of an inch thickneſs, about the pole, taking care not to draw it too tight: then throw on your earth, and beat it down as mentioned before.

When the trench is thus covered, and made into the form of a grave, then draw out the pole. The hay will remain in the hole, and through this the exhalations occaſioned by the fermentation of the roots, will readily eſcape. After ſome days, the hole may be covered with a hollow tile, and when hard froſt comes on, it ſhould be covered with a flat ſtone.

XVI. *How to prepare the roots for feeding beaſts.*

To induce beaſts of all kinds to eat theſe roots, they ſhould be waſhed clean, and then cut in pieces. The inſtrument, uſed for cutting them, is made of a plate of iron, a foot long, and two inche broad, formed in the figure of an S. In the middle there is a ſocket about ſix inches long, in which is fitted a wooden handle, about 3½ feet long. With this inſtrument, the roots are eaſily cut in a trough kept for the purpoſe. A man can, in an hour, chop as many as will ſerve 12 oxen a whole day. Before the roots are thrown into the trough, they ſhould be ſplit, and cut in quarters. It is of advantage to cut the roots very ſmall; cattle thereby receive more benefit from them.

XVII. *For feeding horned cattle.*

Prepared in the manner above directed, the roots may be given, without any mixture, to horned cattle and ſheep, eſpecially if they are for fattening. But if it be neceſſary to uſe economy in the conſumption of the roots, then a quarter, or more, of chopped hay, or cut ſtraw, may be mixed with them. It will be well to do this for the three or four firſt weeks for a lean beaſt, which is put up for fattening; clover, ſain-foin, luzerne, &c. are the beſt for this purpoſe. The Dutch cutting-boxes will render this work light and eaſy.

XVIII. *For horſes.*

Horſes may be kept the whole winter on theſe roots, by mixing them half and half with cut ſtraw or hay. Fed in this manner, they will be fat, vigorous, and ſleek. But when put to continual hard labour, they ſhould have at times ſome grain.

Hogs will alſo eat the roots, mixed with the waſh commonly given them. They fatten on them as well, if not better than on potatoes.

XIX. *The daily allowance for different beaſts.*

The quantity of roots, given to different beaſts, will depend on the quantity of dry forage given them in addition; for they ſhould every day have a little dry forage, before they are watered. The quantity muſt be proportioned to the ſize and largeneſs of the beaſt. It ſhould alſo be proportioned according to what the beaſt is deſigned for. Thoſe, which are for keeping, ſhould have leſs than thoſe put up for fattening. As the ſize of the roots is greater or ſmaller, according to the goodneſs of the ſoil where they grew, the quantity cannot be determined by the number. Weight would be more certain, but every one has not conveniences for weighing.

The abbé then proceeds to ſay, that, from 16,000 roots planted in May, 1785, on two arpents of land, Heidelberg meaſure, which is about an Engliſh acre, he fed ſeven cows and three calves, conſtantly, with the leaves, from the beginning of July to the fifteenth of November; and with the roots from the 20th of November to the ſummer following. The cows were fed twice a day, at each feeding, with 16 or 18 pounds of roots, mixed with one quarter as much cut

ſtraw or hay. Their milk was as good and as plentiful, as in ſummer, and they were kept in excellent condition.

XX. *How to fatten beeves.*

I put up (ſays the abbé) four very lean oxen to fatten. They were fed twice a day, each with twenty pounds of roots, mixed with five pounds of cut hay, of the firſt or ſecond crop. In about a month, by the advice of a ſenſible farmer, I withdrew the hay, and ſubſtituted five pounds of roots inſtead of it. They were fed two months with roots only, and then were ſufficiently fat to be ſold. They always eat their food greedily, becauſe it is tender. I found it beſt to feed both oxen and cows, two or three times a day; as they fatten the faſter for it, and as nothing is waſted or loſt, which is not the caſe, when they have it all at once. From this it is eaſy to calculate, how many roots are neceſſary to keep a cow, or fatten an ox. It commonly requires four months to fatten an ox, on other food; but with theſe roots, or with the leaves, it will fatten in three.

XXI. *The quantity that may be raiſed from an acre.*

An Engliſh acre contains 160 perches, each perch 16½ feet ſquare, and each foot 12 inches ſquare: it may be divided into 18,600 ſquares, of 18 inches diameter. However, making abatement, let us ſuppoſe 16, or even 15 thouſand, if the land be given of an indifferent quality; it is eaſy to conceive what an immenſe quantity of wholeſome nutriment may be raiſed off an acre, and much more, if the ſoil be ſuitable, and a little manure added.

XXII. *Advantages of this culture.*

Beſides the advantages already mentioned, the ſcarcity root has this in its favour, that it is a ſure crop, not ſubject to the uncertainties of the ſeaſons. It ſupplies plenty of food for horſes and cattle, which are houſed; and therefore provides a plentiful ſupply of dung, which is indiſpenſably neceſſary in agriculture; it will keep down the price of other forage, and enable the farmer to increaſe his ſtock, and thereby increaſe the profits of a farm.

XXIII. *How to raiſe calves, weaned at twelve days old.*

The ſcarcity of forage often obliging farmers to kill their calves, it is important for them to be informed, that, by the uſe of this root, they may wean their calves at ten or twelve days old, and, with a little care and trouble, rear them in the following manner.

When the calves are three days old, they ſhould be preſented every day with a little milk, luke-warm, in a wooden veſſel; no matter whether they drink it at firſt or not, it is ſufficient if they wet their lips with it. In eight or ten days, they will come to drink it; they ſhould then be weaned: but the whole milk of the dam ſhould be given to each calf, morning and evening, for three or four days: at noon, inſtead of milk, they ſhould be preſented with luke-warm water ſprinkled with a little flour. When they are twelve days old, they ſhould not any more have pure milk night and morning, but only luke-warm water, mixed with bran and a little milk. This ſhould be continued for four or five days, proceeding as follows: On the fourth day, preſent to each calf, from time to time, a little bran; when it begins to lick it, then put before it a handful of bran, and continue this for twelve days, by which time it will learn to eat. The food ſhould be put in a proper place; which ſhould be cleaned well, every time freſh food is put in. After theſe twelve days, give them three times every day, ſcarcity leaves, chopped and mixed, with one-third bran, and twice a day whitened water to drink. If it be

winter, the roots will ſupply the place of leaves. When the calf is four or five weeks old, the bran may be withdrawn and cut hay or ſtraw ſubſtituted in its ſtead, mixed with an equal quantity of roots or leaves. Whatever the calf leaves, ſhould be removed, and it ſhould always be ſerved with freſh provender, to prevent diſguſt. In this manner, the abbé ſays, he has found by experience, that calves may be very well raiſed.

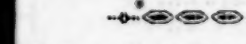
Mr. Carey.

Encloſed I ſend you an extract from the tour of Arthur Young, eſq. in Ireland—The teſtimony of this gentleman, an eye witneſs of the fact related, muſt place it beyond the poſſibility of a doubt, or ſuppoſition of miſtake or error. If the publication ſhould induce any of our country gentlemen to try the experiment, I ſhall be more than paid for the trouble I have taken in communicating it to you. A. B.

On the uſe of oxen in huſbandry.

LORD Shannon, upon going into tillage, found that the expenſe of horſes was ſo great, that they eat out all the profits of the farm, which made him determine to uſe bullocks: he did it in the common method of yokes and bows; but they performed ſo indifferently, and with ſuch manifeſt uneaſineſs, that he imported the French method of drawing by the horns: and in order to do this effectually, he wrote to a perſon at Bourdeaux, to hire him a man who was practiſed in that method. Upon the correſpondent being applied to, he repreſented difficulties attending it, the man who was ſpoken to, having been in Germany for the ſame purpoſe. Upon which, lord Shannon, gave directions, that every thing ſhould be bought and ſent over, which the labourer wiſhed to bring with him. Accordingly a bullock of the beſt ſort, that had been worked three years, was purchaſed; alſo a hay-cart, a plough, harrows, and all the tackle for harneſſing them by the horns, which, with the man, were ſent over. His ſalary was to be four hundred livres per annum, with board, &c. The bullock coſt two hundred and eighteen livres; tackle for two bullocks, thirty-ſix; two carts, three hundred and fourteen; a plough and harrow, one hundred and twenty-three; which, with other expenſes, came to forty-five pounds ſeventeen ſhillings—and freight, ſixteen pounds ten ſhillings. Upon the whole, the experiment coſt, from firſt to laſt, to bring it thoroughly to bear, about one hundred pounds. His lordſhip is perſuaded, that the firſt year of his introducing it at large on his farm, ſaved him the whole. He has purſued the method ever ſince, and with the greateſt ſucceſs. He finds the bullocks ſo perfectly at their eaſe, that it is a pleaſure to ſee them. For firſt breaking uplays, and for croſs-ploughing, he uſes four, but in all ſucceeding earths only two—not more for the firſt ploughing of ſtubbles. I ſaw ſix ploughs doing this in a wheat ſtubble, and they did it five or ſix inches deep with great eaſe. Upon firſt introducing it, there was a combination among all his men againſt the practice; but lord Shannon was determined to carry his point in this matter. He followed a courſe that had all imaginable ſucceſs—One lively ſenſible boy took to the oxen, and worked them readily. His lordſhip at once advanced this boy to eight-pence a day: this did the buſineſs; others followed the example, and ſince that, he has had numbers, who could manage them, and plough

well as the Frenchman. They plough an acre * a day with eaſe, and carry very great loads of corn, hay, coals, &c. Four bullocks, in the French cart, brought twelve barrels of coals, ſhip meaſure, each five cwt. or three tons: but the tackle of the fore couple breaking, the other two drew the load above a mile to a forge. Two of them drew 35 cwt. of flag ſtone three miles, with eaſe: but lord Shannon does not, in common, work them in this manner: three tons he thinks a proper load for four bullocks. Upon the bailiff's mentioning loads drawn by thoſe oxen, I expreſſed many doubts—his lordſhip immediately ordered the French harveſt cart to be loaded, half a mile from the ricks—it was done—10,200 ſheaves of wheat were laid upon it, and two oxen drew it without difficulty. We then weighed forty ſheaves, the weight 251 lb. at which rate, the 10,200 came to 6475 lb. or above three tons, which is a vaſt weight for two oxen to draw. I am very much in doubt whether in yoke they would have ſtirred the cart ſo loaded. The uſe of yokes is out of the queſtion. The only compariſon now wanting is with collars.



A ſhort account of the planet Herſchel.

By Benjamin Weſt, eſq. F. A. A.

TIME, ever pregnant with wonders to be unfolded, has at length brought to our knowledge another planet of our ſyſtem, which has been concealed from the eyes of mortals, ever ſince the creation. Great are the works of the Deity! his myſteries how inſcrutable! even by the moſt ſtrict attention of the human ſagacity. The mind of man never ſatiated with knowledge, will undoubtedly go progreſſively on—ſtill making more new and marvellous diſcoveries in the works of nature.

As much has been ſaid, and little written, by the American philoſophers, on the ſubject of this newly diſcovered ſtar, I thought it a tribute due to my fellow-citizens, to give them this ſhort account of it; and that it was firſt diſcovered to be a planet, by mr. Herſchel, after whom the planet is named. The Britiſh aſtronomers, contrary to all the other aſtronomers in Europe, have named it the Georgium Sidus, after the king of Great Britain; but, let the Americans, in agreement with the French and German philoſophers, hereafter diſtinguiſh this planet by the name of the Herſchel.

I know of nothing which led mr. Herſchel to direct his optic tube at this ſtar, more than mere accident. From the beſt accounts, which I can get, it was ſome peculiarity in its colour, different from the reſt, that cauſed him to give more than ordinary attention to it; † and, from repeated obſervations, he found the ſtar made ſenſible changes of place from time to time; was thence led

NOTE.

* 1 $\frac{3}{5}$ acre, Engliſh or American meaſure.

NOTE.

† October 2d, 1782, mr. Herſchel mentions ſome part of his apparatus, wherein he endeavoured to imitate the colour of the ſtar; ſays, he was ſtruck with the different colour of its light; which brought to his mind certain ſtars in Andromedæ, Bootis, Hercules, Cygni, and other coloured ſtars. The planet unexpectedly appeared bluiſh. October 22d, the planet was perfectly defined with a power of 227; had a fine ſteady light, of the colour of Jupiter, or approaching to the light of the moon.

to conclude it was a planet of our ſyſtem. It is but reaſonable to ſuppoſe this diſcovery was immediately communicated to all the aſtronomers, and philoſophers, in Europe; and the firſt, whom I found attempting any calculations of its motion, was mr. De la Lande, who, in a letter to the authors of the Journal des Scavans, printed in Paris, writes thus:

"Gentlemen,

"In your journal for February, 1782, you have given the elements of the circular orbit which I had calculated for the new planet, which has been diſcovered by mr. Herſchel: that calculation was found to err $\frac{1}{3}$, about the beginning of the preſent year; and the errors were ſuch as ſhewed that the planet had accelerated its motion. About that time, M. de la Place, by an analytical method of his own invention, calculated the elements of its eliptic orbit. He makes the greater ſemi-axe 19,0818 ſemi-diameters of the earth's orbit; the half excentricity ,9815: the place of the aphelion, on the 21ſt of Dec. 1781, to be 11 ☌, 23° 22′ 58″; true anomaly of the planet, at 18h. 5m. 40 ſec. mean time, at Paris, 90° 20′. 19″, and its mean anomaly, 102° 52′. 7″.

"Mr. Bode, having remarked, in the ephemeris of Berlin, for 1784, that the ſtar, number 964, of Mayer's catalogue, could not well be any thing elſe than the planet Herſchel, as that ſtar cannot now be found in the place where Mayer obſerved it; pains have been taken to examine the manuſcripts of that celebrated aſtronomer, which are preſerved at Gottingen; and the date of the obſervation, on which the poſition of that ſtar was grounded, is September 25th, 1756, at 10h. 21m. 21 ſec. mean time at Paris; and gives its longitude, at that time 11 ♌, 16°, 37′, 43″, and its latitude 4°, 43″ ſouth."

This obſervation made by mr. Mayer, nearly twenty-five years prior to that of mr. Herſchel, and found, as it were, by a kind of accident, not to have been expected or hoped for, appears to agree ſo well with the computation made from the elements of M. de la Place, before recited, that we may look on the orbit of this new planet as already inveſtigated to a great degree of exactneſs.

Mr. Mayer made this obſervation when the planet was exceedingly near its aphelion; a circumſtance which greatly enhanced its value, as that important point of its orbit was thereby calculated with the greater facility. The place of the node, for the year 1781, is found with great exactneſs, to be Gemini 12°, 47′, and the inclination of the orbit to the plane of ecliptic, 46′, 13″; the greateſt central equation 5°, 27′, 17″, when the correſponding mean anomaly is 3 ☌, 3°, 24′, 31″. From the elements here laid down, the planet's place may be calculated, for any point of time, with great facility and exactneſs.

From this theory of M. de la Place, I have computed the period of the planet to be eighty-three years, and almoſt thirty-three days; and from a known theorem, firſt diſcovered by Kepler and afterwards demonſtrated by the illuſtrious NEWTON, I find its mean diſtance from the ſun to by 19,041 of ſuch parts as the mean diſtance of the earth is unity. M. de la Place, as I have before related, computed it at 19,0818, and M. de la Lande, at 18,913; but as mine falls between them both, it gives me reaſon to hope it is not far from the truth. If we ake the mean diſtance of the earth from the ſun, as it has been ſtated from the two obſervations on the tranſit of Venus, viz. in 1761 and 1769, and multiply it by 19,041, it gives, very nearly, 1805 millions of miles for the mean

diſtance of the Herſchel. I have by me, a number of obſervations on the diameter of this planet, made by mr. Herſchel, with his improved micrometer, and from eight of thoſe which beſt agree among themſelves, I find the mean apparent diameter of the planet to ſubtend an angle of 4″,06; and, were the earth to be viewed at the ſame diſtance, it would ſubtend an angle of no more than ,908 of a ſecond; then, if 4″,06 be divided by ,908, it will give 4″,4713 for the number of times the diameter of the planet exceeds that of the earth; and this, at once, gives for the diameter of the Herſchel, 35511 miles nearly; and ſhould its ſolidity be computed, it will amount to no leſs than 23,409,870,186,568 cubic miles. And furthermore, if we compare its magnitude with our own planet, it will be found to be nearly as 90,688 to one, or as 117,169 to 1292.

From the Pennſylvania Magazine.

The old Bachelor.—No. V.

Continued from page 91.

Letter to the married man.

DEAR SIR,

I Have read the detail of your numerous misfortunes; but as I judge you have ſtepped out of your real character, and given me, in maſquerade, the hiſtory of ſome diſaſtrous neighbour, I ſhall take the liberty of conveying, through you, not a ſword, ſir—I am no duelliſt—but my beſt advice to him.

I conjecture that your hero is a knight of the ancient and honourable order of the thimble; one of thoſe party-coloured citizens—in whom the merchant and the mechanic are unmeaningly confounded, ariſing, ſome ſay, from their wilfully miſtaking queen Elizabeth's command for a compliment, who, in reprimanding their want of order in a lord mayor's proceſſion, vociferouſly called out, march on, taylors; which they curiouſly converted to the appellation of merch-ant taylors.

Now, ſir, I have no patience with this man, becauſe he has ſo much. He appears to me, in plain terms, to be a hen-pecked huſband, and hens never triumph over any other than a dunghill cock; the want of dignity in the one, begets inſult in the other. If he examines himſelf, he will find that what he calls patience, is fear; his humility, duplicity. Why, ſir, it was as much as his head was worth, with all its ornaments, not to go back for the band box. It was not to procure peace, but to prevent puniſhment, that he obeyed. Little minds have little fears, and tremble at every thing. He timorouſly ſubmits, becauſe he does not know how to command. Women will naturally aſpire to ſupremacy, when the proper head of a family does not fill out the character: yet they are tempted more by the vacancy, than by any original deſire to diſpute precedency. A governing woman is never truly happy, nor a ſubmitting huſband perfectly reconciled. While he keeps right, ſhe will not go wrong; neither can ſhe poſſeſs his place, unleſs he go out of it. And it infallibly happens, that when a woman acts the man, the man acts the fool.

This, ſir, is my opinion of your knight of the woful countenance. Were I young, and had a wife, you ſhould ſee other doings. I am under much fear for his ſafety, ſince the publication of your memoirs of him. I doubt he'll hear of other things than wire caps, and perhaps feel ſomething weightier than arguments. Poor man!

(To be continued.)

Addreſs to the congreſs of the thirteen ſtates.

LETTER I.

I AM ſorry, gentlemen, that your unbounded ambition, unbridled extravagance, and confounded impudence, oblige me thus publicly to animadvert upon your conduct. Do you expect, then, by threats of coercion to terrify us into the embrace of deſpotiſm? Be aſſured, they will avail you as little as the arts, fraud, and ſophiſtry heretofore made uſe of. The plan ſhould have been reverſed; for by the latter, your weakneſs has been expoſed, and contempt is now the attendant of the former. Shall the independent ſtate of New York be made a dupe to your body? Warmed with the love of liberty, ſenſible of our importance and ſtrength, and informed of the arts of deſigning deſpots, we are neither to be terrified nor deceived. Central in ſituation, extenſive in domain, ſtrong in number, important in commerce, fruitful in agriculture, invincible in war, and inexhauſtible in reſources, we dare all the terrors of your reſentment, and the combination of your powers. View the reſiſtleſs floods of our Mohawk, with the rolling waves of our Hudſon, and behold a picture of our importance and ſtrength; recollect the ſhores waſhed by theſe waters, and the hardy tribes that dwell upon their ſtreams. Obſerve the forts at Weſt-Point—the key of America.

Do you imagine we will for ever be ſporting away local advantages, the gifts of nature, merely to gratify your ambition? have you not tacitly conſented to the independence of our rebellious counties in the north, and have not we acquieſced, to pleaſe you? and do you imagine we will now betray the intereſts of our infatuated merchants, by yielding the impoſt? 'Tis not our duty to ſuffer our children to embrace the wiſhed-for deſtruction, or to liſten to their petitions, when we know their intereſt better than they do themſelves. Why are not your high mightineſſes diſpoſed to meet the jealouſies of our people? Are you not their ſervants, and created by them? and ſhall the creature be above the creator? Why would not the impoſt, granted till the ſitting of the next legiſlature, anſwer your purpoſe? a committee of reviſion would then be appointed, who ſhould examine your accounts of expenditure, and, taking atteſtations from a proper number of your body, as vouchers of your good behaviour, would then eaſily obtain a grant of an extenſion of the impoſt, provided there was no ſuſpicion of collufion. Hoſtages ſhould be given us by the non importing ſtates, as an additional ſecurity; not that we fear the ſucceſs of your ambitious aims, for we know our ſtrength;—but to prevent our carrying ſlaughter and devaſtation into thoſe ſtates, which, deceived by your chicane, may be diſpoſed to execute your commands. You ſay it is more reaſonable that one ſtate ſhould meet the deſires and intereſt of the united ſtates, than that you ſhould meet the groundleſs jealouſy of one: but this is nothing to the purpoſe. You hold up to view the reſentment of France, Holland, &c. &c. 'Tis a mere bagatelle: Great Britain will as readily become our faithful ally againſt her natural enemies, as ever France did; and the firſt ill conſequences of a rupture will be felt by the merchants, which will be the juſt puniſhment for the eſpouſal of their preſent meaſures. It is ſaid the public creditors will be as great a thorn in our ſide, as were the tories in the late revolution. We have two means of obviating this objection to a rupture. In the firſt place, we will allure the domeſtic creditor to exchange your continental for our

ſtate ſecurities; he will conſequently be then intereſted to ſtand with us. And ſecondly, in place of all ſuch as are not caught by this bait, we will adopt the tories, by our alliance with Great Britain. Thus you ſee, gentlemen, we are prepared for you at all points: perhaps you may hear from me again.

A non-impoſt man.

New York, April 6, 1786.

N. B. Don't pretend to let any of your emiſſaries reaſon with me, becauſe I know they are cunning enough before hand, and ſhall ſtop my ears.

LETTER II.

I Expected your arts of inſinuation were more to be feared than the undiſguiſed efforts of your preſent power: the event juſtifies the perſuaſion. My laſt week's addreſs has been treated with ſilent contempt, except by your emiſſaries abroad; ſome of whom, ſenſible of the juſtice of its ſentiments, are unable to conceal their rage and indignation; others, better inſtructed by you, aſſect to laugh and call it a burleſque; but we hope to convince the world, by the ſteadineſs of our principles, that we are not the jeſting fools you think us; and to convince your high impudineſſes, I ſhall deem the few following obſervations ſufficient.

1ſt. You ſay the impoſt is now the general wiſh of the beſt informed citizens of theſe ſtates. Although you have found means to induce the far greater part of the reſpectable, though infatuated inhabitants of this city, to ſign the petition in your favour, lying at the coffee-houſe and elſewhere; yet your artifices being detected (tho' our legiſlature may favour it with a hearing) it will be treated as it merits. Impertinent petitions are not always to be attended to, whether they originate from the dupes of morality or policy; for this reaſon it is of little conſequence to you, that you have loſt, by your pride in its ſtyle, the names of the greater body of the quakers, (I mention it only as an inſtance how the wicked frequently betray their own cauſe:) the quakers are as foolithly tenacious as any people, of what you call national honour, but what they chooſe to call public honeſty: they will tell you "That righteouſ-" neſs exalteth a nation, and that " perfidy and injuſtice are the ſhame " of a people," and a deal of ſuch buckram ſtuff.

2d. You ſay that a government cannot ſubſiſt without a head; we acknowledge it, but ſee not the neceſſity of placing it ſo high, in reſpect to the other members, as you wish. We will illuſtrate our idea by a ſimilitude, drawn from the ſea, the great element you pretend (with how much ſincerity I will not undertake to ſay) to have principally in view. The ſea turtle—is not his body a perfect piece of machinery? and yet he hides his head under his ſhell; let the ſhell reſemble the ſtate of New York; we will cover you from every approaching danger; we are able to reſiſt the preſſure of national misfortune, and bear up againſt every impending deſtruction. You will allow the ſimilitude to be juſt, as far as it reſpects the preſent ſimpleneſs of government. But pray why need you wiſh to be more perfect than the works of nature? Activity and energy—alas, the moſt diabolical ideas are couched under thoſe terms—for who is more active and energetic than the devil?

3d. You ſay that although congreſs cannot and do not demand the impoſt of the ſtate of New York, as a matter of right, ſtill ſhe will be anſwerable to juſtice and humanity for the conſequences of her ob-

ſtinacy. As the public debt muſt be paid—as national credit muſt be eſtabliſhed—as neither can be effected but by a fixed, certain, and productive fund—as ſuch a fund cannot be provided but by an equal, general, and permanent revenue—as no one has or can point to a mode of revenue, ſo eaſy, ſo equitable, and ſo unexceptionable as the impoſt—as the wiſdom of the continent, repreſented in congreſs, has for five years deemed it the only efficient mode—the meaſure appears important and neceſſary. In anſwer, I ſay, the major is falſe, the minor impertinent, and the concluſion ridiculous. The debt need not be paid; national credit is a proud fancy; funds are the means to betray our liberties; a revenue impoveriſhes the people; and the wiſdom of congreſs is the ambition of deſpots.

4th. Your emiſſaries abroad ſay we are counteracting our own intereſt; that the day is aſſuredly approaching, when payment will be demanded of the foreign debt; the means not being furniſhed to congreſs, coercive meaſures will be purſued by foreign powers. France, juſtified by our baſe ingratitude, will levy upon our ſhipping, perhaps with a predilection to this ſtate; our commerce will be, perhaps, totally obſtructed; our merchants ruined; our farmers incumbered with the worthleſs produce of their induſtry; our creditors rouſed to do themſelves juſtice; our affairs thrown into confuſion, and the blood of our citizens ſhed! Pogh, pogh, it's all nonſenſe; we are no more afraid of the king of France than we are of you; and as for the Hollanders, many of us can talk Dutch to them!

5th. Your emiſſaries abroad likewiſe ſay, that all the arguments made uſe of by us, to juſtify the partial appropriation of duties to our own and ſole uſe, apply with greater force in favour of this city; that we are an importing ſtate, chiefly by means of this city; that nature has given this city this advantage, and that the ſtate ought not to deprive them of their natural rights, nor ought they tamely to yield them; that this city is not more connected with the ſtate, or concerned in its intereſt and welfare, than this ſtate is, or ought to be, in the intereſt and welfare of theſe united ſtates, and that when the impending cloud is ready to burſt deſtruction upon their heads, they would be juſtified by every principle of retaliation, policy, juſtice, and nature, to declare their rights and their attachment to federal meaſures, to ſeek independence from uſurpation, and to claim protection from the federal head: upon my word, theſe are great ſwelling words; but, like the baſeleſs fabric of a viſion, leave not a wreck behind. To conclude, and as I ſhall not attempt to give you any further information in future, I would adviſe you, gentlemen, to reconſider the matter; put what end can this reſtleſs ſpirit of domination anſwer to you, as individuals? Surely you do not forget that you are ſoon to return and mingle with the maſs of citizens; your very exiſtence depends daily upon our pleaſure, nay our caprice, and then ſurely you muſt experience equally with us all the ill conſequences of your ill meaſures. Beware then of the imp-oſt, ſurly oſt, the blackeſt imp that ever winged a paſſage from hell to puniſh and perplex a nation.

A non-impoſt man.

New York, April 13, 1784.

Advantages of newſpapers.

THE world was never bleſſed with any mode of communicating knowledge among the bulk of mankind, equal to that of newſ-

papers. No publications are put ſo frequently into the hands of ſo many people. No book or pamphlet contains ſuch a variety, eſpecially of the hiſtorical, political, and moral kind. Theſe are ſent weekly, and at ſhorter intervals, into the habitations of more than three quarters of the ſubjects of every truly free people. And men muſt be either very ſtupid, or exceſſively vain and conceited of their attainments, to perſuade themſelves they can gain no uſeful entertainment by giving theſe vehicles of information a candid reading once a week. Some there are profeſſedly of this claſs; but, if the whole truth could be come at, it would appear that a criminal ſelfiſhneſs, a dread at parting with nine or ten ſhillings a year, is the real cauſe of their complaint.

I ſaid there is no mode of communicating knowledge equal to this: I repeat it, notwithſtanding ſome will ſay the practice of preaching weekly on Sundays and other public occaſions, is better adapted to inſtruct mankind than the mode I am applauding. Preaching is a good inſtitution: and, like every thing elſe that requires the aid of time and experience to bring it to maturity, is advancing rapidly towards perfection. It is probable the time will come, when this will be equal, in ſome reſpects, to the other: it will always be a better poliſh for the manners and tempers of the people, than the reading of newſpapers; but it will be ſome time yet before the inſtruction received from this ſource, in country towns in particular, will be ſo uſeful, as to politics, hiſtory, philoſophy, and morality, as what may be had by a due attention to newſpapers.

The aſſembling together, once a week, of all kinds—black, white, and copper-coloured—of all ranks—officers and privates—of all degrees—rich, poor, and beggars—of all occupations, from the firſt miniſter of ſtate to the ſcavenger in the ſtreet—I ſay, ſuch an aſſembly, where each one is endeavouring to pleaſe, circumvent, or deceive ſomebody elſe—where every one wears a face and garment he has not had on ſince the laſt Sunday, though a very curious ſubject for philoſophy, is very beneficial to ſociety.

The benefit reſulting from Sundays is not ſo much in the article of knowledge and general ſcience, as in refinement of manners and behaviour, in taſte and civility. Hence it becomes a matter of uſeful enquiry, whether Sundays, as they have been for many years obſerved, or balls and aſſemblies, are productive of moſt good to ſociety; or rather, as the former are more frequent than the latter, the compariſon ought not to turn upon the quantity of good actually produced, ſo much as upon the natural tendency of theſe aſſemblies reſpectively to work the good of man, by improving manners, behaviour, taſte, and refinement.

"A newſpaper!" ſays a young merchant—I ought to have ſaid a huckſter—"I take the paper, but do not look into it from one month to another. I cannot ſpend my time in reading newſpapers." He had rather rub his ſhoes and buckles, and keep them bright, than rub the ruſt of ignorance from his mind. But he ought to know that men of ability, in his line of buſineſs, acquire uſeful information in their profeſſion, as well as other branches of knowledge, by attending to theſe publications. And it may be doubted whether tyranny can rear his iron ſceptre over a people, where a free preſs is enjoyed, and a frequent circulation of newſpapers takes place among all orders and ranks of ſociety. But more of this in another delirium.

CRAZY JONATHAN.

ANECDOTES.

AT the commencement of the late revolution, when the French nation appeared inclined to take part in the conteſt in favour of America, ſir Joſeph Yorke, the ambaſſador from England to the United Netherlands, meeting the French ambaſſador at the Hague, cenſured his court for interfering in the diſpute, and taking ſo ungenerous a part. "You have been guilty of a diſhonourable act, ſaid he, that is unpardonable—no leſs than that of debauching our daughter." "I am ſorry, replied the French ambaſſador, that your excellency ſhould put ſuch a ſevere conſtruction upon the matter. She made the firſt advances, and abſolutely threw herſelf into our arms; but, rather than forfeit your friendſhip, if matrimony will make any atonement, we are ready to act honourably, and marry her."

NOT long ſince, a perſon viſited the city of New York, under the ſtyle of nobility. For ſeveral months his manner of living accorded with his aſſumed character. His lodgings, his attendants and his equipage, correſponded only with rank and opulence. Faſhion received from him its laws, and taſte appealed to him as its genuine ſtandard. Balls, aſſemblies, and entertainments, welcomed him as their principal ornament; while ſenators and ambaſſadors were pleaſed to be enrolled as his companions. In this career of glory, he addreſſed a young lady, highly reſpectable for her character and connexions: but, at the very eve of marriage, by the freſh appearance of the ink, which he had uſed in forging certain deeds, deſigned as proof of great family property, and by a diſpute with a perſon about the price of the parchment on which one of them was written, he was diſcovered to be a miſerable vagabond, whom infamy would have bluſhed to acknowledge as her offſpring.

WHEN George Whitefield firſt came to Charleſton, in South Carolina, the rev. Alexander Garden was epiſcopal miniſter of that place. Not liking Whitefield's principles, he took occaſion to preach a ſermon againſt him from the following text,—"Behold, thoſe that have turned the world upſide down, are come hither alſo." In the afternoon of the ſame day, Whitefield, in his turn, retorted upon his antagoniſt to a very crouded audience, and with all the wit and ſatire for which he was ſo remarkable, from theſe words of St. Paul, "Alexander the copperſmith hath done me much evil; the Lord reward him according to his works." Soon after, Garden, not to be outdone, took occaſion to declaim with ſome heat, againſt the light and trifling tunes uſed in Whitefield's church, as being too theatrical and gay for holy worſhip, and ſuch as had been long appropriated to profane ſongs and airs. "Very true, doctor," ſaid Whitefield in his next lecture: "but pray, ſir, can you aſſign any good reaſon why the devil ſhould always be in poſſeſſion of the beſt tunes?'

BON MOT.

SOME officers of the Britiſh army who had ſerved during the American war, walking in Hyde-Park dreſſed in their regimentals, met a man deformed by a haunch on his back, when one of them jocularly clapping his hand thereon, exclaimed, "What have you got here, my friend!" To which the other, with a countenance expreſſive of his ſenſe of the inſult, replied, "Bunker's hill —damn your red coat."

POETRY.

A elegy, on lieutenant De Hart, volunteer aide-de-camp to general Wayne. By colonel Humphreys.*

WHEN autumn all humid and drear,
With darkneſs and ſtorms in his train,
Announcing the death of the year,
Deſpoil'd of its verdure the plain:
When horror congenial prevail'd,
Where graves are with fearfulneſs trod,
De Hart by his ſiſter was wail'd—
His ſiſter thus ſigh'd o'er his ſod:

" Near Hudſon, a fort, on theſe banks,
" Its flag of defiance unfurl'd:
" He led to the ſtorm the firſt ranks;
" On them iron tempeſts were hurl'd:
" Tranſpierc'd was his breaſt with a ball—
" His breaſt a red fountain ſupply'd,
" Which, guſhing in waves ſtill and ſmall,
" Diſtain'd his white boſom and ſide.

" His viſage was ghaſtly in death;
" His hair, that ſo laviſhly curl'd,
" I ſaw, as he lay on the heath,
" In blood, and with dew-drops impearl'd.
" How dumb is the tongue, that could ſpeak
" Whate'er could engage and delight!
" How faded the roſe on his cheek!
" Thoſe eyes how envelop'd in night!

" Thoſe eyes, that illumin'd each ſoul,
" All darken'd to us are now grown:
" In far other orbits they roll,
" Like ſtars to new ſyſtems when gone.
" My brother, the pride of the plain,
" In vain did the graces adorn:
" His bloſſom unfolded in vain,
To die like the bloſſom of morn.

" Oh war, thou haſt waſted our clime,
" And tortur'd my boſom with ſighs:
" My brother, who fell ere his prime,
" For ever is torn from my eyes.

NOTE.

*This young warrior was killed in the attack on the block-houſe near Fort Lee, 1780.

" To me how diſtracting the ſtorm,
" That blaſted the youth in his bloom!
" Alas, was ſo finiſh'd a form
" Deſign'd for ſo early a tomb?

" How bright were the proſpects that ſhone!
" Their ruin 'tis mine to deplore—
" Health, beauty and youth were his own,
" Health, beauty and youth are no more.
" No bleſſings of nature and art,
" Nor muſic that charm'd in the ſong,
" Nor virtues that glow'd in the heart,
" Dear youth, could thy moments prolong!

" Thrice ſix times the ſpring had renew'd
" Its youth and its charms for the boy;
" With rapture all nature he view'd:
" For nature he knew to enjoy.
" But chiefly his country could charm,
" He felt—'twas a generous heat—
" With drums and the trumpet's alarm,
" His pulſes in conſonance beat.

" Ye heroes, to whom he was dear,
" Come weep o'er this ſorrowful urn,
" Come eaſe the full heart with a tear—
" My hero will never return:
" He died in the dawn of applauſe,
" His country demanded his breath;
" Go, heroes, defend the ſame cauſe;
" Avenge, with your country, his death."

So ſang on the top of the rocks,
The virgin in ſorrow more fair:
In tears her blue eyes; and her locks
Of auburn flew looſe on the air.
I heard, as I paſt down the ſtream;
The guards of the foe were in view:—
To enterpriſe fir' by the theme,
I bade the ſweet mourner adieu.

An ode—to Laura.—By the ſame.

OH, lovely Laura, may a youth,
Inſpir'd by beauty, urg'd by truth,
Diſcloſe the heart's alarms,
The fire, in raptur'd breaſts that glows,
Th' impaſſion'd pang, on love that grows,
And dare to ſing thy charms?

Enough with war my lay has rung ;
A ſofter theme awakes my tongue—
'Tis beauty's force divine.
Can I reſiſt that air, that grace,
That harmony of form and face ?
For ev'ry charm is thine.—

Of health, of youth th' expanding fluſh,
Of virgin fear the flying bluſh,
With crimſon ſtain thy cheek :
The bee ſuch nectar never ſips,
As yield the roſe-buds of thy lips,
When ſweetly thou doſt ſpeak.

'Tis thine the heavieſt heart to cheer,
Thoſe accents, drank with eager ear,
So muſically roll.
Where ſwells the breaſt, the ſnow-white ſkin
Scarce hides the ſecret thoughts within ;
Nor needs diſguiſe that ſoul.

With thee, of cloudleſs days I dream ;
Thy eyes, in morning ſplendors beam
So exquiſitely fair—
What taſte ! as o'er thy back and breaſt,
In light-brown ringlets neatly dreſt
Devolves a length of hair.

Unblam'd, oh, let me gaze and gaze,
While love-ſick fancy fondly ſtrays,
And feaſts on many a kiſs ;—
For us let tides of rapture roll,
And may we mingle ſoul with ſoul,
In ecſtacies of bliſs !

A ſong—tranſlated from the French.—By the ſame.

IT rains, it rains, my fair,
Come drive your white ſheep faſt ;
To ſhelter quick repair,
Haſte, ſhepherdeſs, make haſte.

I hear—the water pours,
With patt'ring, on the vines :
See here ! ſee here ! it lours—
See there, the lightning ſhines.

The thunder doſt thou hear ?
Loud roars the ruſhing ſtorm :
Take (while we run, my dear)
Protection from my arm.

I ſee our cot; ah hold !
Mamma and ſiſter Nance,
To open our ſheep-fold,
Moſt cheerily advance.

God bleſs my mother dear,
My ſiſter Nancy too !
I bring my ſweet-heart here,
To ſleep to night with you.

Go dry yourſelf, my friend,
And make yourſelf at home—
Siſter, on her attend :
Come in, ſweet lambkins, come—

Mamma, let's take good care
Of all her pretty ſheep ;
Her little lamb we'll ſpare
More ſtraw, whereon to ſleep.

'Tis done—now let us haſte
To her ;—you here, my fair !
Undreſt oh what a waiſt !
My mother, look you there.

Let's ſup ; come take this place ;
You ſhall be next to me :
This pine-knot's cheerful blaze
Shall ſhine direct on thee.

Come taſte this cream ſo ſweet,
This ſyllabub ſo warm ;
Alas ! you do not eat :
You feel ev'n yet the ſtorm.

'Twas wrong—I preſs'd too much
Your ſteps, when on the way :
But here, ſee here your couch—
There ſleep, till dawn of day

With gold the mountain tips :—
Good night, good night, my dove,
Now let me on your lips,
Imprint one kiſs of love.

Mamma and I will come,
When morn begins to ſhine,
To ſee my ſweet-heart home,
And aſk her hand for mine.

An epitaph written the day after the capitulation of lord Cornwallis, at York-town, in Virginia. By the ſame.

ALEXANDER SCAMMEL,
Adjutant general of the American armies,
and
Colonel of the firſt regiment of New Hampſhire,
while
he commanded
a choſen corps of light infantry,
at the
ſucceſsful ſiege of York-town, in Virginia,
was,
in the gallant performance of his duty, as field-officer of the day,
unfortunately captured,
and
afterwards infidiouſly wounded—
of which wound he expired at Williamſburg, Oct. 1781.

WHAT, tho' no angel glanc'd aſide the ball,
Nor allied arms pour'd vengeance for his fall;
Brave Scammel's fame, to diſtant regions known,
Shall laſt beyond this monumental ſtone,
Which conqu'ring armies (from their toils return'd)
Rear'd to his glory, while his fate they mourn'd.

Anacreontic.

An impromptu, for the pocket-book of a young lady, who expected to embark ſoon for Europe, and who expreſſed a wiſh to be poſſeſſed of ſome manuſcript verſes written by colonel Humphreys.

MAY you, fraught with ev'ry grace,
All the charms of mind and face,
Ripen fair in wiſdom's beam;
Thine the bliſs that poets dream;
Happier ſtill thy proſpects ſhine;
And each wiſh fulfill'd be thine!

Riches make them wings and fly;
Envy blaſts the buds of joy;
Deadly pangs may youth invade,
When the roſy cheek muſt fade;
Only virtue can impart
Our defence—it ſoothes the heart,
Death diſarms, or blunts his dart.

The genius of America. A ſong. By the ſame.

Tune, the watry god, &c.

WHERE ſpirits dwell and ſhad'wy forms,
On Andes' cliffs, mid black'ning ſtorms,
With livid lightnings curl'd—
The awful genius of our clime
In thunder rais'd his voice ſublime,
And huſh'd the liſt'ning world.

" In lonely waves and waſtes of earth,
" A mighty empire claims its birth,
" And heav'n aſſerts the claim.
" The fails, that hang in yon dim ſky,
" Proclaim the promis'd era nigh,
" Which wakes a world to fame.

" Hail, ye firſt bounding barks that roam,
" Blue, rolling billows, topp'd with foam,
" Which keel ne'er plough'd before!
" Here ſuns perform their uſeleſs round,
" Here rove the naked tribes embrown'd,
" Who feed on living gore.

" To midnight orgies—off'ring dire!—
" The human ſacrifice on fire,
" A heav'nly light ſucceeds—
" But, lo! what horrors intervene,
" The toils ſevere, the carnag'd ſcene,
" And more than mortal deeds!

" Ye fathers, ſpread your fame afar,
" 'Tis yours to ſtill the ſounds of war,
" And bid the ſlaughter ceaſe;
" The peopling hamlets wide extend,
" The harveſts ſpring, the ſpires aſcend,
" Mid grateful ſongs of peace.

" Shall ſteed to ſteed, and man to man,
" With diſcord thund'ring in the van,

" Again deſtroy the bliſs ?—
" Enough my myſtic words reveal,
" The reſt the ſhades of night conceal
" In fate's profound abyſs."

The monkey, who ſhaved himſelf and his friends.
A fable. Addreſſed to the hon. ——— ———.
By the ſame.

A Man who own'd a barber's ſhop
At York, and ſhav'd full many a fop,
A monkey kept for their amuſement ;
He made no other kind of uſe on't—
This monkey took great obſervation,
Was wonderful at imitation,
And all he ſaw the barber do,
He mimick'd ſtrait, and did it too.

It chanc'd, in ſhop the dog and cat,
While friſeur din'd, demurely ſat ;
Jacko found nought to play the knave in ;
So thought he'd try his hand at ſhaving.
Around the ſhop in haſte he ruſhes,
And gets the razors, ſoap and bruſhes ;
Now puſs he fix'd (no muſcle miſs ſtirs)
And lather'd well her beard and whiſkers,
Then gave a gaſh, as he began—
The cat cried, waugh ! and off ſhe ran.

Next towſer's beard he tried his ſkill in,
Tho' towſer ſeem'd ſomewhat unwilling :
As badly here again ſucceeding,
The dog runs howling round and bleeding.

Nor yet was tir'd our roguiſh elf :
He'd ſeen the barber ſhave himſelf;
So by the glaſs, upon the table,
He rubs with ſoap his viſage ſable ;
Then with left-hand holds ſmooth his jaw ;—
The razor, in his dexter paw,
Around he flouriſhes and ſlaſhes,
Till all his face is ſeam'd with gaſhes.
His cheeks diſpatch'd—his viſage thin
He cock'd, to ſhave beneath his chin ;
Drew razor ſwift as he could pull it,
And cut, from ear to ear, his gullet.

MORAL.

Who cannot write, yet handle pens,
Are apt to hurt themſelves and friends.
Tho' others uſe them well, yet fools
Should never meddle with edge-tools.

The banks of Kentucke. Tune, banks of the Dee.

THE ſpring was advancing, and birds were beginning
To ſing on the boughs o'er each purling brook;
On the early green herbage at leiſure reclining,
I was careleſsly viewing the banks of Kentucke.
Hail, ſtranger to ſong! hail, deep channell'd river!
Thy prominent cliffs ſhall be famous for ever;
Thy high-ſwelling floods henceforward ſhall never
Obſcurely roll down thro' the banks of Kentucke.

Diſguſted with idle, romantic pretenſions,
The populous city I lonely forſook;
Delighting in nature, with fond apprehenſions,
I eagerly came to the banks of Kentucke.
O, never did art ſo much beauty diſcover,
To reward the long ſearch of its moſt raptur'd lover,
As nature's luxuriant fancy ſpreads over
The gay fertile ſoil, on the banks of Kentucke.

Here genius ſhall rove with an endleſs deſire,
Improvements to make without learning or book;
While virtue and truth ſhall forever conſpire,
To bleſs thoſe that dwell on the banks of Kentucke.
Here, far from tyrannical power removed,
The ſpirit of freedom ſhall happ'ly be proved;
The patriot ſhall by his country be loved,
And live without guile on the banks of Kentucke.

Here bigotry never ſhall raiſe its foul banner—
The baſis of joy through all ages it ſhook;
The young and the aged, in more happy manner,
Than thoſe, ſhall improve on the banks of Kentucke.
In honeſt induſtry their time ſtill employing,
With heart-cheering mirth all their meetings enjoying,
With the bleſſings of friendſhip, and love never cloying,
All ranks ſhall unite on the banks of Kentucke.

Rich plenty, and health, with his viſage all glowing,
Invite and allure us with promiſing look;
Never more to regret other rivers long flowing,
Nor ſuch as glide down thro' the banks of Kentucke.
Pale ſickneſs doth paſs thro' the land as a ſtranger,
No dreadful diſtemper here frightens the ranger,
As he paſſes thro' cane-brakes and waters, no danger
Expecting to meet on the banks of Kentucke.

FOREIGN INTELLIGENCE.

PETERSBURG, *Oct.* 20.

THE empreſs has ordered a levy to be made, of one man in every hundred, of all her ſubjects, through the ſeveral provinces. This will produce at leaſt 100,000 recruits, who will be ſent to replace the veterans, that may be deſtroyed in action, or otherwiſe, throughout the army.

Francfort, Nov. 13. It is calculated, that from 1776, to 1786, the number of emigrants, from the Palatinate of the Rhine, amounts to 9000, notwithſtanding which the population has increaſed 21,099 ſouls, the number of people being at this moment 404,085 perſons.

Edinburgh, Nov. 26. On Saturday laſt came on, at the hall of the royal medical ſociety, the annual election of preſidents, when the following gentlemen were choſen:

James C. Maclairen, of London.

Theobald M'Cenna, A. M. County Tipperary.

John Fleming, M. A. Weſtmeath.

Benjamin Smith Barton, A. M. Philadelphia.

London, December 4.

An overture for a triple alliance between the houſe of Bourbon, and the courts of Peterſburgh and Vienna, had been put in a train of negociation by the court of France, and the final accompliſhment of it had been urged by that reſtleſs people, with all the induſtry and zeal that ambition, intereſt, and a natural love of miſchief could inſpire.

A complete ſtop has been put to the ambitious project, by the prudence and judicious policy of Ruſſia.

The Ruſſian clergy have offered the empreſs 100,000 roubles, towards carrying on the war againſt the Turks.

The following may be depended on, as an accurate ſtatement of the importation into Kingſton, Jamaica, from the united ſtates of America, from December 31, 1786, to March 18, 1787.

Staves, heading, and ſhingles		2,458,000
Lumber	feet	440,000
Boards		72,124
Ditto	feet	346,000
Spars		100
Oars		120
Maſts		7
Pieces of timber		342
Hoops		301
Plank	feet	48,813
Bread and flour	caſks	6,983
Ditto, barrels		11,483
Meal, ditto		250
Corn, hogſheads		2,270
Ditto, barrels		8,783
Peas, barrels		43
Rice, tierces		441
Ditto, caſks		1,252

On the 16th ult. their high mightineſſes declared null and void the act of confederation, ſigned at Amſterdam by ſeventy-five regents, the 8th of Auguſt laſt; and reſolved to defend, with their lives and fortunes, the eſtabliſhment of the ſtadtholder.

Dec. 21. In conſequence of a council held on Wedneſday, at the Cockpit, it was determined immediately to commence a new coinage of copper; and, in order to put a total ſtop to counterfeit half-pence and farthings, which are now ſo great a burden to the public, it was reſolved, that in the new arrangement, one pound of copper ſhould be made into twenty four half-pence, inſtead of eight and forty, which has been the practice hitherto, and the farthings in the ſame proportion of ſize and weight.

Theſe reſolutions will be put into execution in the courſe of a few weeks: and an order of council will probably be iſſued almoſt immediately to ſtop the circulation of counterfeit copper.

DOMESTIC INTELLIGENCE.

Lexington (Kentucke) *Nov.* 12. We have received information that a few days ago, the Indians killed three men on the road from Kentucke to Cumberland, and that a great body of Indians have ſince been ſeen near the Sinking Spring, ſuppoſed to be at leaſt two hundred in number, and appeared to be making towards the Wabaſh.

Norwich, Jan. 24. Within the compaſs of twelve miles from the ſtate-houſe in this town, no leſs than eight bridges have been deſtroyed by the flood, occaſioned by the ſtorm of the 16th inſtant.

Charleſton, (S. C.) *Jan.* 15. We are informed by good authority, that mr. Squibb has diſcovered a new ſpecies of Oryza, or rice, indigenous to this ſtate. The plant ripens its ſeed in June, and appears to be perennial.

Jan. 31. Major Butler ſtated yeſterday to the houſe of repreſentatives, that he had juſt received a letter from Georgia, from a member of the legiſlature at Auguſta, mentioning that they had ſent ſeveral diſpatches to congreſs, earneſtly requeſting aſſiſtance againſt the Indians, but received for anſwer, that there was not a ſufficient number of members to conſtitute a congreſs, and therefore no relief could be ſent, and that Georgia could not raiſe any men; which had given additional ſpirits to the Indians, who were preparing for war in greater force than before.

Feb. 28. A new mode of applying ſteam to machinery has been diſcovered by meſſrs. Iſaac Briggs and William Longſtreet, both of Georgia; and ſanguine expectations are formed of its utility. We have been favoured with the following deſcription, viz. Their engine is ſo conſtructed, that the ſteam operates, alternately, at each end of an horizontal cylinder, on a piſton, which it cauſes to vibrate both ways with equal force; that this force is not checked by cooling the cylinder, the unavoidable conſequence of an injection of cold water, but that an alternate condenſation, in the cylinder on each ſide of the piſton, is effected by means of metallic pipes ſurrounded by cold water, ſo that there is always a vacuum on one ſide of the piſton, when the ſteam is acting on the other; and that the ſteam, when condenſed, becoming warm water, is forced into the boiler again by a ſmall pump.

Baltimore, Feb. 29. The legiſlature of the ſtate of North Carolina have called a convention, for the purpoſe of "diſcuſſing the momentous ſubject of the federal conſtitution," to meet on the ſeventeenth day of July next.

Springfield, March 5. We hear from Ludlow, that about five or ſix weeks ago, a dog belonging to mr. David Fuller of that place, ran mad, and bit a number of cattle; ſeveral of which, about three weeks afterwards, were ſeized with violent madneſs, and have ſince died. Mr. Fuller himſelf was alſo bitten by his dog, about the ſame time, on his hand, in ſuch a manner as to make the blood come very freely; but we are happy to hear, that it has not, as yet, produced any bad effect.

Elizabeth-town, March 5. A company of men, in the ſtate of New York, have, in violation of the conſtitution, and to evade the exiſting laws, taken a leaſe from the Mohawk Indians, for nine hundred and ninety-nine years, of 12,000,000 acres of land, at the annual rent of 125l. The matter has been canvaſſed before the legiſlature, who have deemed the procedure illegal, and the leſſees not entitled to any emolument accruing from it. They conſider it, to all intents and purpoſes, a purchaſe, which their laws forbid.

Carliſle, March 5. A narrative of facts, reſpecting the manner in

which the priſoners were liberated from their confinement in the jail of Cumberland county, on Saturday the 1ſt of March, inſtant:

It is preſumed the public are already in full poſſeſſion of the cauſe which gave riſe to the following tranſactions, viz. the oppoſition made by ſome of the inhabitants of the borough of Carliſle, to the rejoicing intended to be celebrated by the federaliſts, on the 26th and 27th of December laſt. It is already known, that a number of depoſitions were taken in the office of John Agnew, eſq. with an intention to criminate the ſeveral perſons who were active in oppoſing ſaid rejoicing, on which depoſitions, or other information, laid before the honourable the ſupreme juſtices of the ſtate of Pennſylvania, a warrant was iſſued, charging the ſaid oppoſers with divers unlawful acts, &c. and commanding the ſheriff of this county to apprehend twenty perſons therein named, and take them before ſome of the juſtices of the ſupreme court, or any of the juſtices of Cumberland county, to anſwer to the premiſes, and be dealt with according to law. Some time after, the ſheriff received the warrant, and called upon the defendants, and informed them ſuch warrant was in his hands—each perſon willingly agreed to appear at any time he might think proper, before any magiſtrate of this county: he thought proper to appoint Monday the 25th of February laſt, for them to appear before John Agnew, eſq. which they readily complied with. The warrant being read, which exhibited the charge of a riot againſt the defendants, they demanded that they ſhould be confronted with the witneſſes, and offered, if permitted, to produce ſufficient evidence to exculpate themſelves from the charge alleged againſt them, which was refuſed, as the magiſtrate was of opinion, that it was not in his power to ſuperſede a warrant iſſued by the ſupreme juſtices. In the interim, a country magiſtrate arrived, who had been previouſly ſent for by John Agnew, eſq. After a ſhort conſultation they came forth, and the country juſtice told the defendants that in his opinion the warrant admitted of a hearing, but added, that he was determined not to act in the matter, and adviſed the defendants to accept of a propoſal made by mr. Agnew, which was, to remain in the cuſtody of the ſheriff, until the 25th of March next, at which time mr. Agnew hoped to have inſtructions from the ſupreme juſtices. Seven of the defendants abſolutely rejected the propoſal, unleſs they were aſſured of an inveſtigation of the premiſes at the time above mentioned, which was likewiſe refuſed. Bail was then demanded by the juſtice; the defendants anſwered they were conſcious that they were guilty of no crime againſt the laws of their country; and as they were proſecuted to gratify party-ſpite, they were determined not to enter bail on the occaſion, but would otherwiſe willingly comply with the orders of his worſhip; upon which mr. Agnew wrote and ſigned their commitment, and gave it to the ſheriff, who conducted the priſoners to the county jail. Immediately the country took the alarm, on hearing that a number of perſons were confined in priſon for oppoſing a meaſure that was intended to give ſanction to the propoſed federal conſtitution. The people, who compoſed the different companies of militia in this county, thought proper to collect, and appointed to meet in Carliſle, on Saturday laſt, to enquire why thoſe perſons were committed, and at the ſame time determined to act agreeably to the oppoſition offer-

ed them by the rejoicing party. Accordingly about ſun-riſe the bell began to ring, and the men under arms made their appearance from different quarters, who previouſly had appointed one perſon from each company to repreſent them in a committee, for the purpoſe of conſulting on ſuch meaſures as might be moſt expedient on the occaſion. Previous to their meeting, five perſons with delegated power from the people of Dauphin county, had met a number of federaliſts, and had propoſed terms of accommodation. In one hour the federaliſts promiſed to give them an anſwer, at which time they accordingly met, together with the committee appointed by the different companies, who immediately agreed upon terms of accommodation, and mutually conſented to tranſmit a petition to council, ſigned by a number of reſpectable perſons on both ſides of the queſtion; they then agreed that the ſheriff ſhould ſign the following diſcharge.

Be it known, that I Charles Leeper, eſq. ſheriff of Cumberland county, do hereby diſcharge from their impriſonment in the jail of this county of Cumberland, the following perſons, viz. James Wallace, William Petrikin, Thomas Dickſon, Samuel Greer, Bartholomew White, Joſeph White, Joſeph Young, and Joſeph Steel.

CHARLES LEEPER, ſheriff.

After the above agreement was ratified, the militia were marched under their reſpective officers from the public ſquare to the jail, where the ſheriff conducted the priſoners to the ſtreet: having read the above diſcharge, they were reſtored to their former liberty with loud huzzas and a feu de joye from right to left of the companies, who then marched out of town in good order, without injuring any perſon or property, except by firing two balls through a tavern-keeper's ſign.

New-York, March 10. Eliſha Thomas, of New-Durham, in New Hampſhire, whom, not long ſince, we mentioned to have murdered a captain Drown, made his eſcape, but ſoon after was apprehended, and committed to the jail in Dover. Thomas left at home his wife and ſix children. Some days after, his wife, taking with her, her youngeſt child in her arms to one of the neighbours, ſet out for Dover, to ſee her huſband. In the night, the other five being in bed, the eldeſt of them was awaked from his ſleep by the falling of a board from the wall on the bed, which, with the houſe, he ſaw was in a flame. Springing inſtantly from the bed, he in vain attempted to ſave from the flames his four brothers and ſiſters, who, with the houſe, in a ſhort time were reduced to aſhes, himſelf only eſcaping to tell the news.

The repreſentatives of the quakers in New England, have petitioned the aſſembly of Rhode Iſland, againſt the act for making paper money a tender, and likewiſe againſt that for making notes and accounts void, if not ſettled in two years. The aſſembly have received the petition, and referred it to the next ſeſſion, ordering copies of it, in the mean time, to be publiſhed and diſtributed.

The ſtate convention of New Hampſhire has adjourned from Exeter to Concord, about one hundred miles inland, there to meet on the third Wedneſday in June next. Previous to this adjournment, for eight days, very warm debates were had upon the propriety of adopting the conſtitution.

By the accounts received laſt evening, we find, that the adjournment of the convention of New Hampſhire was carried by 56—againſt 51.

Boſton, March 10. A gentleman in this town has received a letter from Charles Logie, eſq. his Bri-

manic majeſty's conſul at Algiers, dated Nov. 5, 1787, of which the following is the ſubſtance: after giving an account of his being obliged to confine himſelf to his own houſe above a year, on account of the plague, he obſerves, that notwithſtanding the diſtreſſed ſituation the unhappy American captives are in, by being obliged to mix and work in common with the natives, of whom upwards of three hundred have died of a day, yet only three out of twenty-two have been taken off by that diſtemper—he mentions the death of capt. Coffin, a brother of captain Shubeal Coffin, after a lingering illneſs, on the 2d of November, and that he had afforded him every aſſiſtance in his power—as well as to the captains of ſhips, and to the American people in general there; and this, he ſays, not merely from the common motives of humanity, but from gratitude, he bearing in mind the many civilities he met with in Boſton, from a great number of its reſpectable inhabitants, upwards of twenty years ago. Mr. Logie likewiſe ſays, that the cauſe of humanity would be greatly promoted, by a ſubſcription for the relief of the unfortunate American ſufferers, now in ſervitude there.

Friday a reſolve paſſed the honorable houſe of repreſentatives (but not by a very full vote, the majority being but about eleven) for pardoning and reſtoring to the privileges of a freeman, the famous capt. Luke Day, who for ſome time paſt has been confined in jail in this town.

March 13. The legiſlature of this ſtate has repealed the law offering a reward for the apprehending Daniel Shays, &c.

A petition has been preſented to the general court by Shays and Parſons, praying a pardon, which, it is ſaid, will be granted.

Philadelphia.

March 5. This day, purſuant to his ſentence John White, alias John Tracey, was executed on the commons, for piracy and murder.

March 6. The quarter ſeſſions of the county of Philadelphia began on laſt Monday in this city. Only three bills for larceny, or any other infamous crime, were found by the grand jury; and the property ſtolen in thoſe three caſes amounted to no more than ſixty-two ſhillings.

The aſſembly of Rhode Iſland have paſſed an act appointing the 4th of March, inſt. for the people of that ſtate to convene in town meetings, and there to conſider and determine upon the expediency of adopting the propoſed conſtitution.

March 10. The committee appointed by the general aſſembly, to conſider the petitions preſented in favour of the diſtreſſed Africans, praying a prohibition of the ſlave trade, and an extenſion of the act for the gradual abolition of ſlavery, made a long and liberal report upon the ſubject, and it is referred to the ſame to bring in a bill, to prevent the miſchiefs complained of, and to amend the exiſting law.

The committee appointed on that part of the meſſage from council, reſpecting the paſſing a declaratory act, upon the ſubject of the treaty with Great Britain, made report of a reſolution, that the executive council be informed, that the houſe cannot find any act now in force, which is repugnant to that treaty, or any article thereof, or that tends to reſtrain, limit, or in any manner impede, retard or counteract the operation and execution thereof, or to explain the ſame.

March 19. The hon. George Handly, eſq. is appointed governor of the ſtate of Georgia, in the room of general Jackſon, who has reſigned.

An Auguſta paper of the 16th ult.

ſays, " We hear from Green county, that on Saturday the 2d inſtant the Indians killed captain Autry near Richland creek."

March 20. The manufacturing ſociety of this city have at length obtained two complete machines for carding and ſpinning cotton, one of which cards forty pounds of cotton per day, and the other ſpins fifty threads at a time. We feel infinite pleaſure in communicating this agreeable intelligence to the public, and we have no doubt, that by application to the ſociety, private perſons or companies will be informed how they may be ſupplied with them. As they are of the greateſt conſequence to this country, we beg leave to ſuggeſt the propriety of gentlemen in every town in the ſtate joining to procure one of each. Five lads of fifteen years of age, and a girl of twelve, may tend four ſpinning and one carding machines, which will card and ſpin 12,000lb of cotton per annum.

It is earneſtly hoped that the ſouthern ſtates will pay the moſt immediate and the moſt unremitted attention to the cultivation of cotton, to which their ſoil, their climate, and their population, are all adapted. Without cotton, the newly acquired machines will be of no value; with abundance of that raw material, they may perform wonders.

March 24. By a letter from Georgia, we are informed " that gen. Clark lately fell in with a conſiderable body of Indians, who were defeated after a ſhort conflict. A body of three hundred of them attacked a fort on the Occonees, and were repulſed with conſiderable loſs. They are well armed, and have lately received a great ſupply of military articles from Penſacola."

Late accounts from Pittſburgh mention, that on Monday the 11th of February laſt, the ſuperintendant of Indian affairs diſpatched meſſengers to invite the chiefs of all the Indian tribes within the northern diſtrict, to a general treaty, in the ſpring, to be held by him and the governor of the weſtern territory in conjunction, by order of congreſs, in order, if poſſible, to ſettle all uneaſineſs exiſting between the united ſtates, and the Indian nations, and to eſtabliſh a laſting peace; much is expected from the abilities and accommodating diſpoſition of thoſe gentlemen, whoſe characters, both public and private, are well known. The ſuperintendant ſet off the ſame day to New York, to make the neceſſary arrangements.

It is recommended to the landholders of Pennſylvania, eſpecially thoſe who own unimproved lands, heavily timbered, to conſider the method of making pot-aſh practiſed by the farmers of Ruſſia and Sweden, as related in Poſtlethwaite's dictionary, and the Encyclopædia Britannica. They will find a method of clearing their lands of timber, profitable to themſelves, and very beneficial to the commerce of the ſtate. It is believed, that a ſum greater than our impoſt, might be made by attention to this article. The people of New York have long enjoyed the benefits ariſing from it, and as it ſerves for a remittance to Europe, great ſums are kept in the ſtate, which would otherwiſe be exported.

The committee appointed by the general aſſembly on the 14th of September, to viſit the Pennſylvania hoſpital, reported,

That they have performed that ſervice, and had the pleaſure to find the houſe in perfect good order, and the patients accommodated, with an appearance of decency and comfort, highly commendable.

From the information received of the attending managers, and the obſervation of the committee, they

think it their duty to report, that the managers and perſons employed in the inſtitution appear to have great merit in the execution of this charitable ſervice.

Extract of a letter from New York, March 26.

"Capt. Prince, from Cayenne and St. Euſtatia, at his departure, left at the former port the brig Waſhington, capt. Gardener, belonging to Rhode Iſland, and the ſhip Black Prince, capt. Newman, belonging to Philadelphia, both veſſels from Africa with ſlaves."

March 29. This day the general aſſembly of this ſtate adjourned, to meet on the 2d Tueſday in September next. Previouſly to their adjournment, the houſe ordered five hundred copies of the ſupplement to the law for the gradual abolition of ſlavery, and the ſame number of copies of the militia law, to be printed, and forwarded to the prothonotaries of the reſpective counties, for the information of the public.

The committee of the aſſembly appointed to conſider the operation of the penal law of this ſtate, reported that it would be proper to appoint a committee to bring in a bill, to alter and amend the ſame. A motion was made by dr. Logan to repeal the law, but it was contrary to the general ſenſe of the houſe, and accordingly rejected.

March 31. Late accounts from Charleſton mention, that the fires in that city have been ſo frequent and ſo fatal, that there is reaſon to ſuſpect they have been occaſioned by the ſame gang of incendiaries who have lately travelled from New York to that ſtate.

BANKRUPTS.

Ann Gibbs, of the city of Philadelphia, merchant.

John Ferguſon, of the city of Philadelphia, merchant.

Dean Timmons of the city of Philadelphia, tallow chandler, dealer, and chapman.

William Tilton, late of the city of Philadelphia, now of the town of Pittſburg, merchant.

Stacy Hepburn, of the city of Philadelphia, merchant.

Joſhua Smith, late of Egg Harbour townſhip, county of Glouceſter, ſtate of New Jerſey, now of the city of Philadelphia, merchant.

James M'Cutcheon, of the city of Philadelphia, victualler and butcher.

Hugh Newbigging, of the city of Philadelphia, merchant.

Richard Maſon, of the city of Philadelphia, merchant.

John Fowler, of the townſhip of Lampeter, in Lancaſter county.

MARRIAGES.

Maſſachuſetts. At Boſton, Mr. John Allen, printer, to miſs Sally Rand, of Charleſtown.

New York. Mr. Charles Wilkes to miſs Shaw; mr. Abraham Franklin, to miſs Ann Townſend of Long Iſland.

Maryland. At Baltimore, Mr. James Croxall to miſs Nelly Gittings.

South Carolina. At Charleſton, mr. William Cam, merchant, to miſs Wigfall; capt. John Trott, to miſs Mary Fendid.

Georgia. At Savannah, mr. Frederick Herb, to miſs Mary Brown; mr. Robert Holmes to miſs Betſey Butler.

DEATH.

In Great Britain. Paul Fiſher, eſq. of Cliſton, near Briſtol, who has left to the ſociety for propagating the goſpel two thouſand pounds, of which five hundred pounds is for propagating the goſpel in America; five hundred pounds for encouraging the proteſtant working ſchools in Ireland; and the remaining one thouſand pounds for the uſe of the firſt biſhop that ſhall be appointed in America, with the intereſt of the ſame, provided a ſee be conſtituted in twenty-five years.

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